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THE MASSACHUSETTS HOME-PROJECT PLAN OF VOCATIONAL AGRICULTURAL EDUCATION

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Agent, Massachusetts Board of Education

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1914

CORN TESTING AT SMITH'S AGRICULTURAL SCHOOL, NORTHAMPTON, MASS.

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LETTER OF TRANSMITTAL.

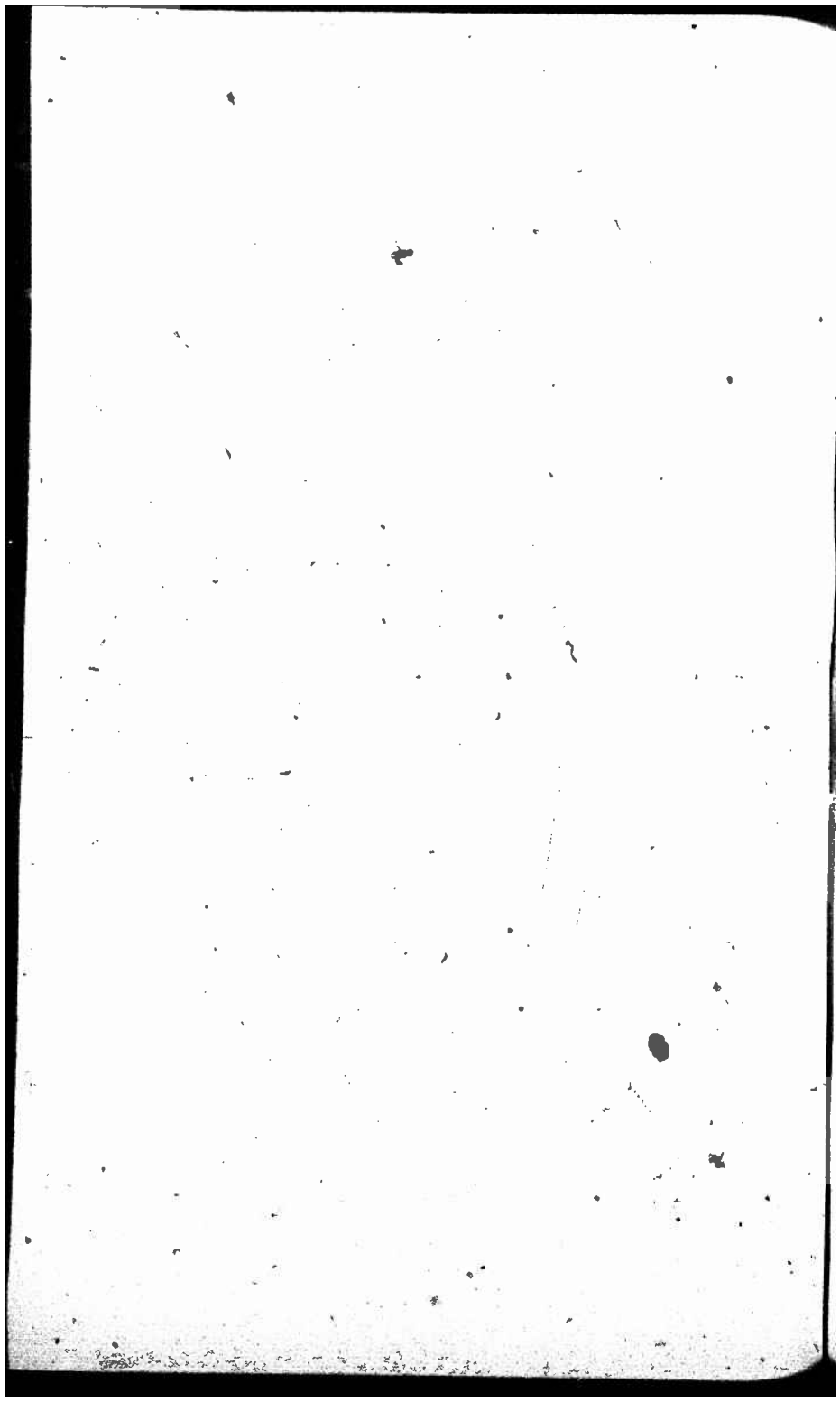
DEPARTMENT OF THE INTERIOR,
BUREAU OF EDUCATION,
Washington, September 29, 1913.

SIR: For a large portion of the children of the United States vocational education must mean education in agriculture and the arts of life on the farm. In recognition of this fact, agriculture is now taught in some way and to some extent in hundreds of public high schools and in the lower schools of many of the States. Possibly the greatest difficulty in teaching this subject is that of making it sufficiently concrete and practical. Too often the teaching begins and ends with the assignment and recitation of lessons from the pages of a textbook. To make the teaching effective each lesson must follow the necessary pedagogical order from concrete experience through interpretation and generalization back to concrete practical application. The pupil must become an intelligent worker and director of his own work and must learn not merely by looking on and listening, but by intelligent participation. The "Home-project plan" worked out in Massachusetts within the last few years and now applied in the State-aided schools of that State makes such intelligent participation possible. By requiring boys to do productive work as a means of instruction, it enables many boys to continue their studies in schools who otherwise would not be able to do so. By projecting the work of the school into the home in the vital way in which it does, it enlists the interest of parents and becomes a means of their education in this subject, thus affecting quickly the work on the farms of the community. Because of the wide interest in this subject, I recommend that the accompanying manuscript, prepared by R. W. Stimson, be published as a bulletin of the Bureau of Education. The report by William T. Bawden on the Types of Massachusetts Agricultural Schools, printed as an appendix, was jointly agreed upon by Mr. Bawden and L. S. Hawkins, L. H. Dennis, and L. H. Carris, of the State Departments of Education of New York, Pennsylvania, and New Jersey, respectively.

Respectfully submitted.

P. P. CLAXTON,
Commissioner.

The SECRETARY OF THE INTERIOR.



THE MASSACHUSETTS HOME-PROJECT PLAN OF VOCATIONAL AGRICULTURAL EDUCATION.

Chapter I.

VOCATIONAL AGRICULTURAL EDUCATION.

1. ELEMENTS NECESSARY TO SUCCESS.

Agricultural education as a phase of vocational education is that form of vocational training which fits for the occupations connected with the tillage of the soil, the care of domestic animals, forestry, and other wage-earning or productive work on the farm. Vocational agricultural education is, thus, one phase of effort toward conserving the valuable years of youth for the best uses of both society and the individual.

There is now a general movement throughout our country for agricultural education of secondary grade. There are probably not fewer than 500 secondary schools in which agriculture is now seriously taught. The training varies from the study of an agricultural textbook in the hands of the general teacher, who does not bring to her task any special training, to the out-and-out vocational school, where the teachers are specialists in agriculture.

(1) **Profitable production the test of efficient training.**—Productive work of a high order of efficiency is coming to be considered the real test of all systems of vocational education of secondary grade. Particularly in vocational agricultural education it is coming to be accepted that the training must be such as to develop both skill and managerial ability. The competent farmer must be not only expert in the varied technique of his calling, but also a sound and progressive business manager.

(2) **Spectator versus participant.**—Neither skill nor business ability can be learned from books alone, nor merely from observation of the work and management of others. Both require active participation during the learning period in productive farming operations of real economic or commercial importance. The masterful constructive imagination may accomplish much for him who possesses it, and for his needs books and observation may finally result in vocational efficiency. The difficulty is that such powerful

imagination is so rare as to constitute him who has it a genius, far removed from the common run of boys 14 to 18 or 20 years of age who live on farms, who expect to follow farming for a living, and whose training is not likely to extend beyond that afforded by the vocational agricultural school.

(3) **Danger—Too much reflection, not enough action.**—In general, if there is a defect in the large agricultural schools which boys must leave home in large numbers to attend, and which, in order to secure adequate attendance to justify their cost, must apparently limit their training to six or eight fall and winter months, it is the defect of putting too great reliance upon books and observation, to the exclusion during the intensive learning periods of active participation in the type or types of productive farming the boys intend to follow after graduation. Too great, one may almost say in the cases of many of the boys fatal, reliance is put on the ability of the students once well grounded in sound theory at the school to put that theory into successful practice on their own farms, alone and unaided. Even if the large school undertook to put its plant and equipment to the strictest possible productive farming uses of a profitable commercial character, and to induct its students into its aims and to school them in its methods, its efforts would be more than likely to break down through sheer weight of numbers. School farms at present can hardly be claimed to be thoroughgoing commercial farming concerns. The most flattering school photographs, where the aims of the school are most emphatically practical, show by far too few actual participants and by far too many spectators. To see a thing done, however good the demonstration, is not to do it oneself. To participate in the carrying out of an enterprise planned and ordered by another—by even an agricultural-school instructor—may leave one little better than a gang laborer. The pittance paid per hour, where any pay at all is given, can hardly, as an incentive to keen interest and alert action, be considered comparable to the reward the student might hope to realize from an independent enterprise planned and executed by himself and wholly for his own profit or that of his family. It must be feared that, however excellent may be its work in selected demonstrations and in certain really valuable experiments, school farming must, from a strictly commercial point of view, always remain more or less artificial. Perhaps the best use to which an agricultural school, large or small, can put its own land or equipment is that of demonstration. Most schools appear to have adopted this view. It is not clear, however, that any considerable number have adopted methods of training calculated to overcome their defects as agencies for graduating students thoroughly trained in the practice as well as theory of practical farming.

Startling and stupendous problem.—The problem, then, of providing for actual participation, both as manager and as worker, in productive farming, simultaneously with his classroom instruction, on the part of the boy in the agricultural school, may fairly be looked upon as the most startling and stupendous problem in the great field of vocational education. How shall it be solved?

2. THE MASSACHUSETTS HOME-PROJECT PLAN.

Massachusetts has developed a plan for the solution of this problem. This plan was fully set forth in the report submitted to the legislature in January, 1911, by the Massachusetts Board of Education. The legislature has provided State aid for carrying this plan into effect. A vocational agricultural school may be established by any town or city, or by any group of towns or cities which may voluntarily form themselves into a district for this purpose. Evening school classes in agriculture may be established by any school committee. The State has not been definitely divided into districts by the legislature, but certain counties have been authorized to maintain agricultural schools.

Provided an agricultural school, day or evening, large or small, taught by one teacher or more, with or without school land and live stock, with training extending over two, three, or four years, a school in general agriculture, or in such specialized production as market gardening—provided an agricultural school is approved by the Massachusetts Board of Education as to "organization, control, location, equipment, courses of study, qualifications of teachers, methods of instruction, conditions of admission and employment of pupils, and expenditure of money," the community, voluntary district, or county maintaining it is entitled to reimbursement from the treasury of the State to the extent of one-half the amount expended for maintaining the school from funds raised by local taxation. The State in agricultural as in industrial education contributes nothing toward the initial cost of land, buildings, or equipment.

Vocational agricultural departments may be established in selected high schools. The agriculture must be taught by a specially qualified teacher who gives his attention exclusively to agriculture. His vacation must be taken during the winter months, usually December, January, and February. He must continue his work throughout the summer. Little stress is laid on land or operations at the schoolhouse. Every possible stress is laid on the utilization of the land and equipment at the homes of the pupils; and it is the instructor's duty during the summer to supervise work prepared for in the agricultural classes, from seed time to the securing of the harvest. In the cases of such departments, the State reimburses the communities

maintaining them to the extent of two-thirds of the salary of the agricultural instructor.

(1) **Part-time work in agriculture.**—A fundamental feature of the Massachusetts plan is embodied in what has been termed "part-time work in agriculture." The term "part-time work" is a descriptive expression brought over from current discussion of certain forms of industrial training, for use in unfolding the possibilities of this new type of training in the field of agricultural education. Part-time work in industrial education means that the student spends part of the time required for his training in the shop or manufacturing establishment, and part of the time at the school building, both school and shop work, however, being intimately related and supplementary to each other. Part-time work as applied to agricultural education means that the student must spend part of the time required for his education in productive farm work, preferably at home, and part of his time at the school, the farm work and school study being closely correlated by the school at points selected from season to season or from year to year, and the farm work being given the highest possible educational value by competent school supervision.

(2) **Economy, efficiency, adaptability.**—The part-time work plan reduces the cost of agricultural training of secondary grade so as to place effective training for the farm within reach of many communities which would otherwise be unable to secure it. Fifty departments in 50 groups of farms should cost no more than five large schools such as those found in other States. It obviates the necessity of sending the boy away from home in order to secure the benefits of agricultural training. The cost of living for the boy is less at home than it would be at a boarding school. Parents who need the help of their boys are deprived of their services during only a portion of the day. The plan also is proving to be wonderfully effective. Cooperative work between the school and the home farm is the most effective known means of trying out under the conditions of individual farms, over widely scattered areas, methods which have proved to be profitable elsewhere, as, for example, at the State Agricultural College or Experiment Station. Such cooperation furnishes effective experimental means by which each boy can try out the merits of the home farm as an agency for producing profits when treated by the best known methods. The principles and methods taught by the school can be positively adapted by each boy to the economic conditions of the farm on which he may spend his working days. Part-time work thus gives to agricultural teaching the reality of actual life as but little school training can give it. Under the part-time work plan, the instruction is adapted to all kinds of farming prevalent in the district surrounding the centers where the work is established. The practical applications of the instruction are thus subject to the obstacles con-

tinually encountered under economic farming conditions found in any given district, just as they are also aided by all the influences in a Commonwealth which make for the improvement of farming. Moreover, in the case of vocational agricultural departments in selected high schools, if for the moment the plan fails, due to insufficient enrollment or the fault of an instructor, the instruction may be stopped, and later be resumed when the local conditions become favorable; meantime there are no expensive buildings and equipment to rust out or rot down.

(3) **Productive farming as educational projects.**—The Massachusetts plan as an educational process becomes immediately effective, because farming activities readily resolve themselves into what may be termed farming projects. A farming project is a thing to be done on a farm. The thing done may contribute some element of improvement about the farm—as constructing a concrete walk leading to the front door; planting and nurturing shade trees; making and maintaining an attractive lawn. The thing done may be of an experimental[1] nature—as the planting of an untried variety of fruit, the feeding of an untried ration, the testing of an untried spraying mixture, or the testing of one or another of much advertised roofing materials. Finally, the thing done may be of a productive nature, as the growing of a crop of clover or alfalfa; the growing of a field of potatoes; the growing of a crop of silage corn, or the production of eggs for the market. A farming project is, further, something to be done on a farm which involves a limited and definite amount of equipment, materials, and time, and which is directed toward the accomplishment of a specified and valuable result.

Finally, a farming project, as the term is here used, is a thing to be done on a farm which, in the preparation for doing it and in the carrying of it out to a successful result, involves a thoroughgoing educational process. The improvement project of constructing a concrete walk to the front door might involve a study of the nature of cement; its action on sand, gravel, and broken stone; its resistant qualities to the weather; the seasons in which it might be used; its cost as compared with other materials, such as boards, plank, tar, brick, flagging, and asphalt; the mathematical determination of proportions of sand, cement, and stone to be used; the geometrical determination of the sections into which it should be divided, and whether it should be crowned or flat; the geographical sources of the raw material and the commercial conditions for purchasing the cement. The experimental project of planting an untried variety of fruit might involve a study of the probable adaptability of the variety selected to the soil of the

[1] It is "experimental" only in the eyes of the boy or his father, for the Massachusetts instructor will encourage only such projects as have been proved elsewhere under like conditions to be feasible. To the instructor every project is a demonstration.

farm, the climate of the locality, and the market demands within reach of the farm. The productive project of growing a crop of clover might involve a study of the various varieties of clover; the comparative adaptability of those varieties to the given field on which the crop must be grown and to the climate of the locality; the most reliable places for the purchase of seed; the best time for seeding; the best time for cutting; the best methods of curing and storing; the mathematical calculation as to the saving in cost of feeding stuffs which the crop would afford; the chemical elements it would furnish in the ration, and the beneficial chemical, biological, and mechanical effects on the soil in which it would be grown.

(4) **School projects and other farm work.**—The home-project or part-time plan of instruction, moreover, fits in nicely in its relation to the usual farm activities of the boy. The boy may help with the milking throughout his course, where the object is to get the cows milked as quickly as possible and where no records are kept. During certain months of at least one year the school should require whatever time may be necessary for keeping an accurate record in pounds and ounces of the yield of a part of the herd. This may be limited to the weighing of milk from a single cow and giving the cow credit for what she produces.

It may be part of the boy's business to assist in feeding the cows. During part of his course sufficient time should be given for weighing the ration and charging at least one cow with what it costs to keep her.

In the original routine to which he has been accustomed in milking, much or little attention may have been paid to the cleanliness of cows, utensils, or the person and clothing of the milker. During part of his time in school the boy should be given whatever time may be necessary for milking at least one cow and preserving her milk under absolutely sanitary conditions, and for sampling the milk for bacteriological tests at the school.

In the original cropping of the farm, much or little attention may have been paid to leguminous crops. During one season at least facilities should be given the pupil for growing a patch of moderate size of clover, and for observing the effect of introducing a large proportion of clover into the ration of the cow.

In the ordinary conduct of the farm much or little attention may have been paid to the selection and testing of corn for seed. But, prior to planting, one season at least, the boy should be given whatever time may be necessary for making germination tests of the corn which it is proposed to plant; also during one season the boy should be given control of a portion of the corn field for making an "ear to row" corn test, for observing the difference in yield between different ears of corn—all the corn from one ear being planted in one row, and all the corn from another ear being planted in another row.

In the ordinary routine of the farm it may be that the boy is required to tend the poultry. During at least one year he should be given control of at least one pen of poultry, and facilities for feeding a balanced ration and trap nesting individual birds for comparison of productivity in laying.

It may be part of the usual work of the boy to help cultivate and harvest the potato crop. During one season at least he should be given facilities for testing the value of the use of formalin for the prevention of potato scab and of the Bordeaux mixture for protection against potato blight.

It may be part of the usual work of the boy to assist in the apple harvest. During one season at least he should be given facilities for pruning at least one tree, spraying it, if it is at all infested by scale, of cultivating under it and fertilizing it. During one season, also, he should be given facilities for grading and packing the fruit from at least one tree and of disposing of the product with a view to securing fancy prices for at least part of the crop. If he could be given control of a block of five trees, and were a fairly husky boy of 15 to 17, the rewards for his work and incentives to intelligent action would be so much the greater.

(5) **Counting the cost of farming.**—An essential feature of the home-project or part-time plan of training is the consideration of cost at all points. The boy by this method learns first of all through his own experience that there can be no product without cost and no profit without excess of receipts over all expenditures. After such an experience he will not be likely to undertake a new enterprise without a serious attempt to estimate accurately his probable profit. The boy is subjected to the prevailing economic conditions under which the home farm must yield a profit or loss at the end of each year of work. The methods by which the boy becomes on a small scale a farmer or business man for himself gives the project which he is carrying on and the school work in which he participates a reality not otherwise attainable. It heightens measurably his interest in the work and in the related study of the school, and must fix better than by any other device the training which he is receiving.

(6) **Parents pledge home cooperation.**—One indispensable condition prior to the establishment of the agricultural departments is that the parents of the boys who desire to take the course shall agree to furnish the facilities necessary for the practical carrying out at the homes of the boys of the teachings of the agricultural instructors, not everything in any single year, but something every year. Parents of farm boys who seek admission to a separate or county agricultural school must also meet this condition. In the cases of village or city boys who think they desire to become farmers, either the parents, or the schools on their behalf, must provide the required facilities for

productive farm work in connection with the phases of farming taught these boys in the classroom.

(7) **Advisory committee.**—Another condition precedent to the establishment of vocational agricultural training in any given locality is the appointment of an "advisory committee" consisting of five progressive farmers to cooperate with the agricultural instructor, or instructors, in adapting the agricultural training to the particular needs of that locality. It is considered desirable, moreover, that at least one member of this committee shall be chosen from among the parents of boys in the agricultural classes and that one shall be a farm woman.

(8) **Promising solution of problem.**—The home-project or part-time plan has attracted wide attention among Massachusetts educators, and its results are being watched with the greatest interest. Many now believe that home farm work, supervised by the school, where conditions are at all like those in Massachusetts, might well be substituted very generally for the present methods of little work, or no work at all, of a *managerial* nature now found in connection with vocational agricultural school training; and that the project method of bringing agricultural science immediately to bear on actual farm practice, in commercial agricultural enterprises, conducted by the boys themselves on their own home farms, is a promising solution of our most pressing problem in this field of vocational training.

A. Young people respond.—This plan was first tried at Smith's Agricultural School, Northampton, Mass. Beginning with the school year 1908–9, this school, of which the writer was then director, has employed a man throughout the summer for the express purpose of assisting the boys in applying the teachings of the school in their home farm work. This man goes from farm to farm, with authority over specific operations. The approach is very modest. It is through the boy. But the work is done on the father's farm, and under the father's eyes. The father may himself follow the methods taught by the school or department in his own larger scaled operations, and not a few of the fathers of the boys are now doing this. The efforts of the supervising instructors, however, are primarily for the assistance of the boys. If the instructors are scrupulously careful to avoid the slightest appearance of interference with the operations of the fathers, they are no less insistent upon the right of their pupils to follow the methods learned at school in the execution of their home projects. This method immediately appeals to the motor instincts and activities of boys of secondary-school age. The success of boys in the corn growing clubs in many States shows that boys instantly respond to help at home. A school-boy of 16 at a recent Massachusetts corn show won the sweepstakes against all comers, including the sweepstakes winner of the previous year at the big New

A. A NORTH EASTON BOY'S BACK YARD BEFORE HE BEGAN STUDYING AGRICULTURE.

B. THE SAME BOY'S BACK YARD AFTER HE BEGAN STUDYING AGRICULTURE.

England corn show, for the best single ear of corn and also the best collection of 10 ears. He had been given seed by the former winner, and had been told and shown out of school hours what to do, and when and how to do it on his father's land. The man who helped him said "That boy has pumped me all summer." Most boys, like most men, learn best by being told and shown on the field of action. Moreover, this sort of response, by which the pupil, and not the teacher, does most of the "pumping," is not only a delightful school experience, but it is, also, counted upon as a fundamental educational factor of the Massachusetts home project plan.

B. Earning and learning.—This method offers the boy, all too eager to quit school for work on reaching his fourteenth birthday, a strong incentive to continue in school, because it bids fair to make him an earner while still a learner. Boys like to feel that as members of the family they are at last able to pay their own way. The highest net profit, so far reported, which was made by an agricultural pupil in 1912 from a home-farm project where live stock was used was $270.24.[1] By "net profit" is meant the profit after the pupil has paid himself for his own labor and met all other expenses in connection with his project. There were some failures to show profit from project work. Figures were radically reduced in a few cases by unseasonable frosts, drought, or blight. One boy's garden was cut back three times, at considerable intervals apart, by killing frosts.

On the whole, the returns were creditable and encouraging.

Twenty-five boys—five from each of five unlike farming sections in Massachusetts, where this plan was in operation in 1912—earned from farm work in connection with making excellent records for scholarships at school, $5,102.30. At the end of this chapter will be found two pages giving details regarding the individual projects of these boys. The table may serve to illustrate, also, the items of accounting for which the pupils are held responsible.[2]

3. PRIZES AND HOME PROJECTS.

Prizes offered by the 30 or more incorporated agricultural societies, each of which receives $200 a year from the State for such purposes,

[1] In this case the pupil had paid himself for labor $109.02. His direct earnings from this project were therefore $379.36. During this period this pupil was allowed, also, $200 credit for other farm work done at home. The cash and credit received by this pupil for farm work during the whole project period, therefore amounted to $579.26. But the accounts covering this project showed the following interesting and significant sums paid or allowed other members of his family: $109.02 for labor, man or horse; $662.47 for rent, hay, etc., or a total for the others of $771.49. This pupil graduated from the Smith's Agricultural School at Northampton in June, 1912. A tabulated statement from the accounts of five pupils from each of the five points in the State where home work had been supervised in the school year 1912 is given on pages 18, 19. No figures for Easton are given, because the vocational agricultural department at that place, as stated in the text, did not begin work until September, 1912.

[2] Thirty boys—five from each of six points—earned from farm work, in connection with the study of their agricultural projects, in 1913, $9,728.03. The scale and the number of the projects carried by the boys in 1913 were practically twice as great as those in 1912.

and by other agricultural and horticultural associations, are proving to be important incentives to home-project work. The agricultural department at Hadley headed the list of winners in 1912 by adding to its local prizes the championship of the State in stock judging. The total amount awarded the Hadley pupils was $243 at fairs, and a trip to Washington, D. C.; won in a corn-growing contest under the auspices of the Massachusetts Agricultural College.[1] Working strictly for profit in a number of cases the past year did not permit of competing for prizes; but the two lines of effort may be harmonized, and, one being conducted as supplementary to the other, the intelligence brought to bear by the boys on their productive farm work can not but be made the keener by such contests.

4. HOME PROJECTS OF NONRESIDENTS.

The Massachusetts law provides that pupils from other towns may attend vocational agricultural schools or departments, and that tuition on their behalf, at rates fixed by the board of education, shall be paid by their home towns. On account of tuition, however, the State reimburses the home towns of nonresident pupils to the extent of one-half the amounts paid.

Attendance of nonresident pupils is subject to approval by the board of education, and their home projects must be properly supervised. This provision is extending the influence of vocational agricultural instruction and supervision over a widening area. One instructor has ridden a circuit the past summer of between 50 and 60 miles, when traveling by the most direct route from boy to boy enrolled in his classes, and his duties as supervisor have taken him regularly into six towns. Another has a circuit of between 40 and 50 miles. The shortest round trip was 30 miles. It may more than once happen that a town which could not alone command a sufficient enrollment to justify the maintenance of an agricultural department in its high school may with the aid of a few nonresident pupils be able to do so. With the extension of its influence, there goes a fair distribution of the cost of maintaining this type of training by means of the State-aided tuition payments.

[1] One hundred and thirty boys, each under 19 years of age, are reported to have competed at local fairs for the preliminary prizes of $15, $10, and $5 in gold. Hadley won first at Amherst and again first at Northampton. At the final contest in Brockton there were 15 competitors, with scholarships at Massachusetts Agricultural College to the value of $150 and $50 offered, and both were won by Hadley. There were five classes to be judged, and a perfect score in each was 60 points for placing and 40 points for reasons, or a possible grand total for the five classes of 500 points. The educational value of the contests was shown markedly in the cases of the Hadley boys, who entered the preliminary contests at both Amherst and Northampton. The five boys who entered both learned so much from their experience at Amherst that they raised their rating in the Northampton contest a total of 217 points, an average of about 40 points each. Other agricultural pupils have won generous amounts, those of the Smith's Agricultural School heading the list, leaving the Brockton fair out of account, with a total of $59 won at local fairs.

5. SALARIES FOR HOME-PROJECT INSTRUCTION AND SUPERVISION.

It will readily be understood that the teaching and supervision necessary to the successful development of the school and home farm cooperative plan of vocational agricultural training require instructors of exceptional ability, both as practical farmers and as students of the various phases of agricultural science which bear upon productive agriculture. So far admirable selections appear to have been made. A fortunate feature of the legislation providing State aid is that there is no limit fixed for salaries. The best man for any given position may be selected, and the local authorities may pay whatever they feel their peculiar conditions warrant in order to secure and retain his services. The salaries at present range from $1,000 to $2,000 a year for members of staffs below the grade of principal or director; but there is an evident desire, wherever possible, to start the instructor at about $1,200 a year.

6. CULTURAL AND AGRICULTURAL.

The division of time in carrying out the school and home farm cooperative method of training, whether in agricultural departments in high schools or in the separate agricultural school, is as follows: For the execution of the projects, including work during vacations and other out-of-school hours, 50 per cent, and for the related study, 30 per cent. The remaining 20 per cent of the time of the boy is devoted to general culture and good-citizenship instruction, wherein systematic courses may be provided in such subjects as English, history, civics, current events, mathematics, and science.

7. FARMING AND GOOD CITIZENSHIP.

Good educational results have already been achieved. It is believed that the Massachusetts plan of vocational agricultural training will justify itself from every reasonable point of view, and will prove to possess undeniable merit as a plan of training both for farming as a definite calling and for intelligent and vigorous participation in the community life of any Commonwealth.

State-aided vocational agricultural education—Examples of the

School or department.	Pupil's age.	Project or projects.	
		Title.	Scope.
1	2	3	4
Northampton	18	Dairying	12 Jerseys, Nov.-June
		Hot-bed	Mar. 1-June 7
Northampton	19	Poultry	22 R. I. Reds
		Potatoes	¼ acre
		Strawberries	1,000 plants
		Hot-bed	Early spring
Northampton	18	Potatoes	¼ acre
		Poultry	28 White Leghorns
Northampton	18	Poultry	52 Barred Rocks, 4 months
Northampton	20	Alfalfa	Seeding down 1½ acres
Petersham	15	Garden and potatoes	¼ acre each
Petersham	14	Garden	¼ acre
Petersham	14	Garden	¼ acre
Petersham	17	Garden	¼ acre
Petersham	15	Garden and potatoes	¼ and ¼ acre
Hadley	17	Fruit and corn	1 acre c., 118 apple trees
Hadley	18	Bees, poultry, corn	3 hives, 25 R. I. Reds, 1 acre c.
Hadley	15	Corn and poultry	1 acre c., 19 birds, 30 chicks
Hadley	18	Fruit and poultry	20 apple trees, off year, and 100 birds
Hadley	16	Poultry	34 R. I. Reds
Northborough	17	Sweet peas	128 sq. rods
Northborough	16	Garden	91 sq. rods
Northborough	16	Potatoes and corn	¼ acre p., 1 acre c.
Northborough	17	Corn and potatoes	1 acre c., ½ acre p.
Northborough	16	Potatoes	¼ acre (drought)
Harwich	15	Garden	¼ acre
Harwich	17	Garden	¼ acre
Harwich	17	Garden	¼ acre
Harwich	17	Garden	¼ acre
Harwich	14	Garden and potatoes	¼ acre
Total for 25 pupils			

income of pupils from farm work during attendance at school.

Pupil's project income.			Other family income from pupil's project.			Cash or credit received by pupil from farm work during project period.			
Net profit.	Paid self for labor.	Total.	Labor, man or horse.	Rent, seed, etc.	Total.	At home.	Away from home.	His own project.	Grand total.
5	6	7	8	9	10	11	12	13	14
$270.24	$109.02	$379.26	$109.02	$662.47	$771.49	$200.00	.....	$379.26	$579.26
37.80	8.80	46.60	.....	4.95					
16.94	6.00	22.94	.....	25.05					
16.28	2.42	18.70	3.10	6.49	64.30	180.00	$14.75	122.94	317.69
26.65	8.05	34.70	16.80	8.00					
11.04	3.46	14.50	.....	1.73					
3.68	3.82	7.50	4.83	8.44	37.16	175.00	68.00	1 51.81	294.81
28.74	4.52	33.26	.....	22.16					
19.22	13.72	32.94	.....	16.10	16.10	.....	162.50	32.94	195.44
.....	4.83	4.83	9.97	31.35	41.32	.....	145.05	4.83	149.88
93.30	16.76	110.06	29.45	1.00	30.45	100.60	48.00	110.06	258.66
44.35	12.00	56.35	5.00	15.35	20.35	164.60	6.08	56.35	227.03
10.67	20.00	30.67	4.00	4.75	8.75	150.00	2.50	30.67	183.17
14.03	11.80	25.83	4.65	16.60	21.25	63.50	22.50	25.83	111.83
18.00	15.00	33.00	23.53	.....	23.53	32.10	38.00	33.00	95.10
68.00	8.45	76.45	47.14	36.75	83.89	157.50	27.00	76.45	260.95
58.50	38.50	97.00	8.00	16.00	24.00	116.00	.....	97.00	213.00
28.27	20.20	48.47	10.80	10.50	21.30	232.00	15.00	48.47	295.47
20.15	6.15	26.30	3.00	2.00	5.00	47.30	125.30	26.30	198.90
7.65	13.50	21.15	.....	3.00	3.00	202.50	12.50	21.15	236.15
43.00	14.70	57.70	.....	.....	.....	168.00	.....	57.70	225.70
30.00	3.00	33.00	3.13	6.00	9.13	185.00	15.00	33.00	233.00
23.50	13.80	37.30	5.85	12.65	18.50	197.50	.....	37.30	234.80
33.10	11.25	44.35	9.25	46.95	56.20	132.00	5.00	41.35	181.35
.92	7.57	8.49	1.40	23.60	25.00	167.50	.....	8.49	175.99
31.27	15.20	46.47	6.00	2.50	8.50	12.00	.....	46.47	58.47
75.00	18.10	93.10	1.90	5.00	6.90	5.00	10.00	93.10	108.10
12.63	22.40	35.03	1.20	4.00	5.20	65.00	.....	35.03	100.03
15.92	6.70	22.62	1.40	1.30	2.70	75.00	5.00	22.62	102.62
7.90	7.00	14.90	9.62	.....	9.62	12.00	38.00	14.90	64.90
1,066.75	446.72	1,513.47	319.04	994.60	1,313.64	2,840.10	752.18	1,510.02	5,102.30

[1] Project income, less shrinkage in inventory of $3.45, gives $51.81.

Chapter II.

AGRICULTURAL PROJECT STUDY.[1]

INFORMATION AND SUGGESTIONS FOR SCHOOL OFFICERS AND INSTRUCTORS AS TO COURSES AND METHODS OF AGRICULTURAL PROJECT STUDY APPROVABLE FOR STATE AID IN MASSACHUSETTS.

1. PRODUCTIVE WORK AND RELATED STUDY.

The home-project or part-time plan of vocational agricultural education embodies, as has been shown in Chapter I, two distinct features. One is productive farm work, supervised by a special agricultural instructor, or group of agricultural instructors; the other is study directly related to that productive work. Both are essential, and for each careful provision must be made.

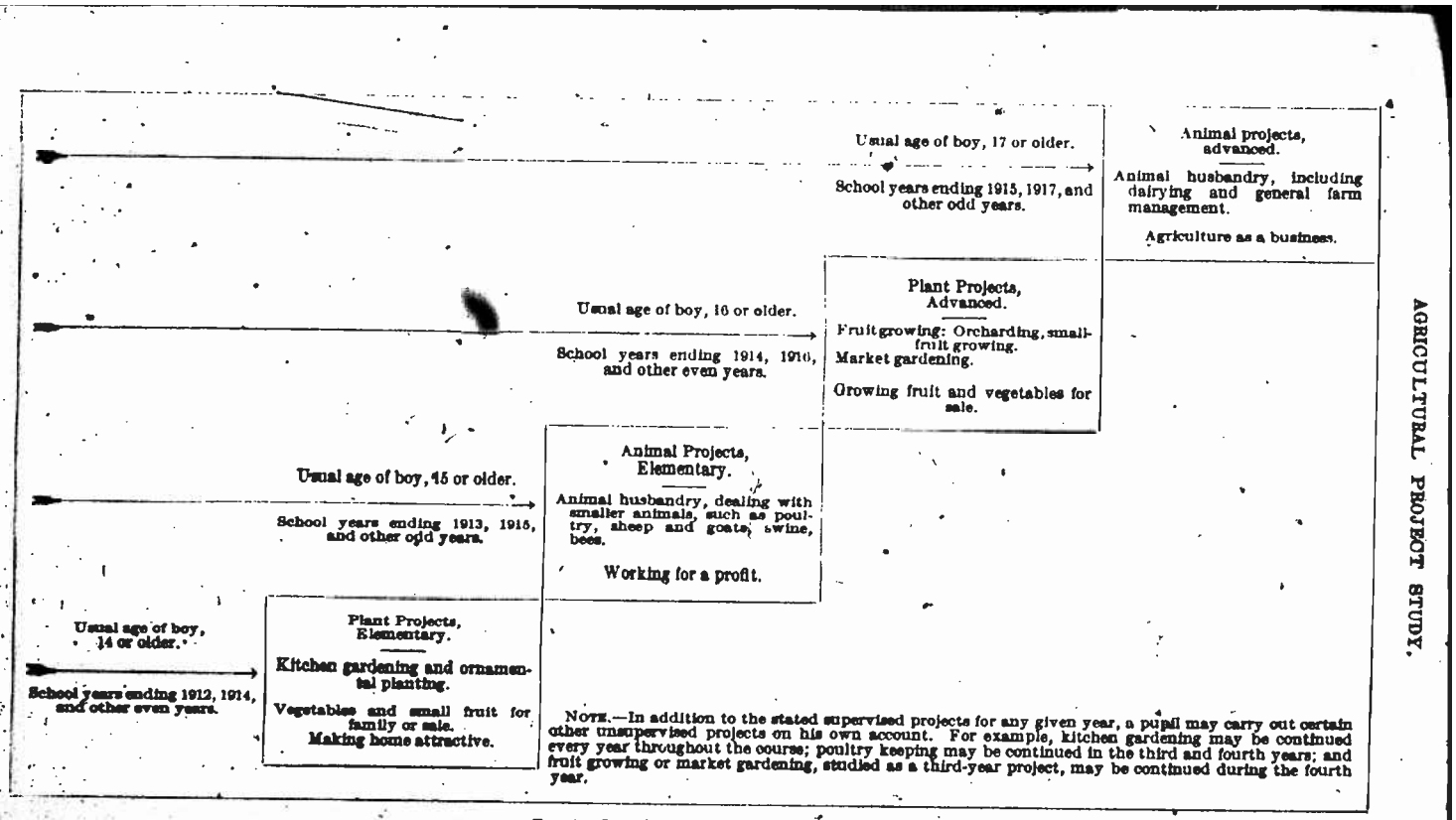
Of the two, it may, perhaps, prove to be an easier task for the special instructor to inspire and to direct competent agricultural production than to amplify and organize the training of his pupils so as to insure thoroughgoing study directly bearing upon their individual enterprises. Study directly bearing upon the projects of the pupils is called "project study."

2. PROJECT STUDY SUITABLE FOR VOCATIONAL AGRICULTURAL SCHOOLS.

(1) **Range and progress.**—Beginning with the boy of 14, who entered a vocational agricultural school in September, 1911, we may graphically represent the contemplated progress of his training from year to year by the following diagram. (See fig. 1, p. 23.) His training should make him acquainted with farm life and affairs in general, and especially well informed and competent in the particular fields covered by his special projects. No boy is required to carry out projects in every field here listed.

(2) **Studies not on diagram.**—Such subjects as agricultural botany, agricultural chemistry, history, civics, and English occupy other portions of the time of the pupils in a regular four-years course.

[1] This chapter is chiefly a reproduction of materials published by the Massachusetts Board of Education in its Bulletin No. 3.



NOTE.—In addition to the stated supervised projects for any given year, a pupil may carry out certain other unsupervised projects on his own account. For example, kitchen gardening may be continued every year throughout the course; poultry keeping may be continued in the third and fourth years; and fruit growing or market gardening, studied as a third-year project, may be continued during the fourth year.

FIG. 1.—School project-study diagram.

3. PROJECT STUDY SUITABLE FOR VOCATIONAL AGRICULTURAL DEPARTMENTS IN SELECTED HIGH SCHOOLS.

(1) **Necessary groupings.**—In order to enable one agricultural instructor to direct the project work and study of each of his pupils during a full half of the school time through a four-year course, groupings by years and projects like those in the following diagram are necessary. These groupings hold during the fall and spring terms. Certain other studies, like those above stated as open to separate agricultural school pupils, may be taken during the winter and during the fall and spring terms; but, if taken, must be so timed as not to interfere with the agricultural project work and study.[1]

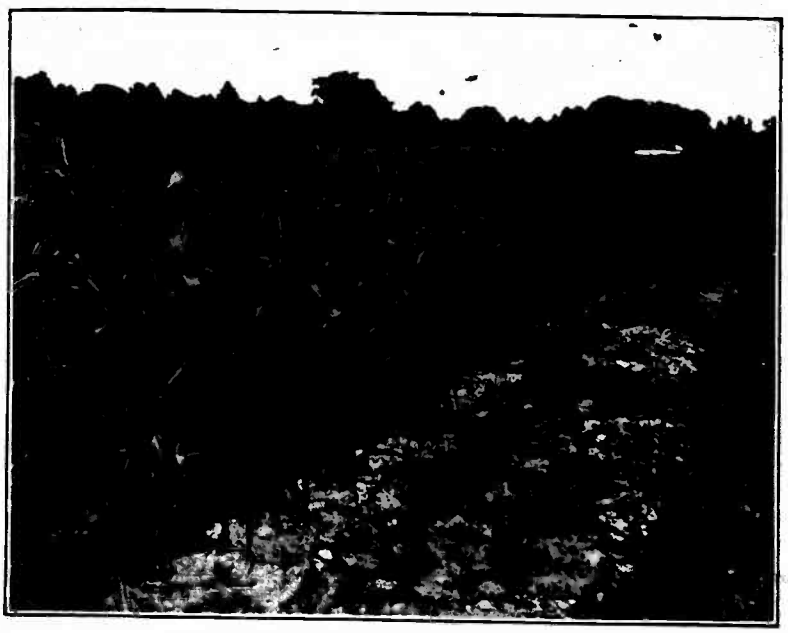
School years ending 1912, 1914, and other even years.	School years ending 1914, 1916, and other even years.
First and second year pupils, one-half school time.	Third and fourth year pupils, one-half school time.
Agricultural science and projects applied to a given community: **Kitchen gardening**—Vegetables, small fruits. **Ornamental planting**—Shrubbery, flowering plants, lawns. **Farm shop work**—Making and repairing for home and school use—hot beds, cold frames, etc.	**Agricultural science and projects applied to a given community:** **Farm animals**—Types, breeding, management. **Farm buildings**—Sanitation and conveniences, plans, construction, upkeep. **Farm crops** for keeping the animals, rotations, balancing, cultivation, etc. **Farm machines** and implements, their use and repair.
School years ending 1913, 1915, and other odd years.	**School years ending 1915, 1917, and other odd years.**
First and second year pupils, one-half school time.	**Third and fourth year pupils, one-half school time.**
Agricultural science and projects applied to a given community: **Small animals**—Poultry, sheep, swine, bees—types, breeding, management, rations, etc. **Buildings and equipment** for small animals—plans, cost, etc. **Home-grown crops** for small animals, kinds, quantities, seeds, soils, place in farm crop rotation, fertilising, tillage, harvesting, storage. **Farm shop work** and other construction.	**Agricultural science and projects applied to a given community:** **Fruit growing**—Orcharding and small fruits not before dealt with, propagation, cultivation, packing, etc. **Market gardening**—Markets, soils, seeds, fertilisers, tillage. **Buildings and appliances**, plans, devices, implements and machines—cost, use, and upkeep. **Farm shop work** and other construction.

Fig. 2.—Department project study diagram.

(2) **Agriculture first.**—The regulations governing these departments further require that when conflict is unavoidable or when, as at planting time, continuous application for a number of consecutive days to his projects becomes necessary, all else must yield to the pupil's proper agricultural instruction, no matter at what cost for the time being to his other studies.

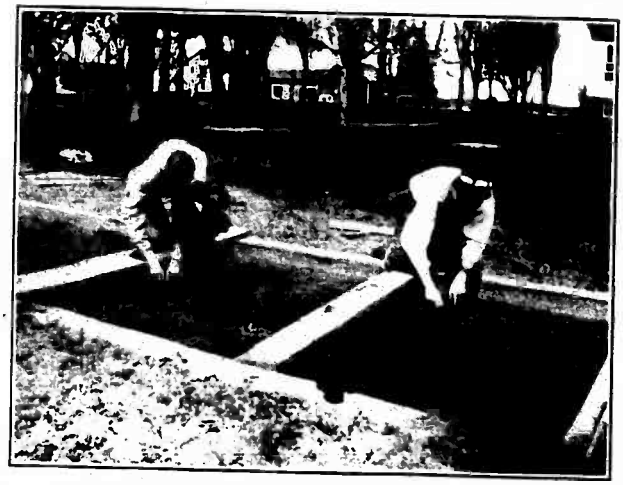
Economic returns as direct incentives to competent training are fundamental here, as in the training of vocational agricultural schools.

[1] The agricultural instructor is given his vacation in winter. A glance at the diagram (fig. 2) will show that in both odd and even years he carries responsibility for both plant projects and animal projects. He is thus well prepared to answer questions of farmers whenever they may turn to him for advice.



A. HOME PROJECT—2½ ACRES OF SWEET CORN.

B. AN "EXTRA" HALF-ACRE MARKET-GARDEN PROJECT.



A. SCHOOL SEED-BED PROJECT AT HOPKINS ACADEMY.

B. COLONY HOUSE AND YARD. ONE OF SEVERAL CONSTRUCTED AND USED BY A POULTRY PUPIL AT HARWICH.

If experience shows that instruction in the departments should be limited to first and second year projects, pupils desirous of third and fourth year project training may later be provided for in the separate or county agricultural schools.

4. PROJECT STUDY CONCENTRATION. YEAR LIMITS.

(1) **Pupil.**—As shown by the foregoing diagrams, the range of the boy's training is expected to be somewhat extensive, covering typical farm products which are feasible for his neighborhood. It is designed, however, that the training of each year shall be complete in itself; also, whatever other projects he may undertake or continue on his own account, that the pupil's first duty in any given year shall be the carrying out of certain projects selected from the groups assigned to that year for study.

(2) **Instructor.**—Similarly, while an agricultural instructor may give advice and assistance privately to pupils who are carrying on extra projects, the first duty of this instructor is to the particular groups of projects published for any given year.

(3) **Published year groups.**—In short, upon the particular project groups published for treatment in any given year the attention of both pupils and instructors should be concentrated.

5. PROJECT STUDY AND CAPACITY OF PUPILS.

(1) **Individual v. Class.**—Careful planning of the project study will be necessary on the part of each instructor. The project method of education more, it is believed, than all others takes into account the aptitudes, requirements, and accomplishments of indvidual pupils as these are revealed from hour to hour.

(2) **Varying capacity.**—Acquaintance with pupils who enroll for vocational agricultural education reveals wide variation among them in capacity for project study. Since farm results under the project method must be obtained, not directly by the instructor, but indirectly through the individual pupils, the instructor's plan should provide for at least an essential minimum of accomplishment on the part of the least capable, for a desirable maximum on the part of the most capable, and for a large body of educational values to be grasped by the greatest number, pupils who are neither the least nor the most capable.

6. KINDS OF PROJECT KNOWLEDGE.

There may be distinguished three phases of instruction in agricultural projects, suited pretty exactly in their varying scope and degrees of difficulty, to the three fairly distinct kinds or grades of capacity found among the agricultural pupils. An analysis of project knowledge which shows these three sorts or gradations will

be of direct assistance to the instructor in formulating his project-study program.

(1) **Rules,** or plans and specifications, however simple in outline and whether on paper or in the mind, are necessary for the intelligent execution of any piece of productive work.

A boy may become a more or less capable farm hand without knowledge in advance of the enterprise, as a whole, upon which he enters. An ordinary laborer is capable of taking orders and of doing routine farm work. Project work under capable supervision should produce a skillful farm hand, but one who desired hand training only should hire out to a progressive farmer.

Project study, the other fundamental of the project method, should produce managerial ability. Good headwork is required for successful farming no less than good handwork. Project study in the case of even the least capable boy admitted to this training should result in evidence of mental accomplishment. A good form of such evidence is a record on paper of the rules by which that boy proposes to be, or has been, governed in the execution of his productive enterprises. Inability or disinclination on the part of any pupil to find or formulate such rules is evidence of his present mental or moral unfitness for this type of training.

Mastery, in short, of the simplest rules by which the success of his productive work must be determined should be looked upon as an essential minimum of accomplishment on the part of the least capable boy who is permitted to remain in the class.

(2) **Reasoning.**—Beyond the precise rules necessary for success in any given project there is the reasoning from experience or from scientific principles, which is their justification. Most of the members of a class readily penetrate to this reasoning; or, at the hands of a capable instructor, are penetrated by it.

The larger educational efforts of the instructor should be directed toward training his boys, not merely in finding the naked rules by which their project work must be governed, but also in discovering the practical experience or the laws of nature which lie back of them; that is to say, he should aim to possess his pupils of rules, not as "rules of thumb," but as rules of reason.

Good farm management depends upon good judgment, upon reasoning power—not on ability to find good rules so much as on ability to make them. In the notebooks of most of the boys, therefore, there should be recorded the general principles which they have mastered and of which their rules have been but particular applications.

(3) **Broader results.**—The third kind of project knowledge may consist of informational materials of many sorts—statistical, commercial, geographical, historical, scientific, social, and the like.

Such knowledge can not be looked upon as a direct tool for carrying out a project. It may directly supply neither a rule nor a reason. It may, nevertheless, consist of many most interesting discoveries, offer much most excellent educational experience, and be of such a nature as to give the young producer what may be termed, in the broader senses of that expression, agricultural horizon.

Such knowledge falls readily within the grasp of the most capable pupil, and may well be considered for him a most desirable maximum of project knowledge.

(4) **Typical for all projects.**—These three kinds of project knowledge are typical for all vocational agricultural projects and years. Of the three, the first and second are in the strictest sense vocational; the third has obvious vocational relations, but may be largely cultural.

(5) **The three R's of the project method.**—It may not be altogether amiss to declare at this point in express terms that in these divisions of project knowledge, "Rules," "Reasoning," and "Broader results," we have the three fundamentals—the three R's—of agricultural study by the project method.

7. PROJECT STUDY RECORDS.

(1) **Of highest importance.**—In view of the above discussion, the project study records of the pupils become of the highest importance. In them we may expect to find the results of the instructor's best efforts as both program maker and teacher.

(2) **A supposed project.**—The groups of projects published for the school year ending in 1914 include kitchen gardening. A constituent of kitchen gardening is vegetable growing. Suppose that the boy's main project is providing all, or a part, of the home vegetable supply. Suppose a subproject to be the production of lettuce. Suppose, finally, that we consider the knowledge related to this subproject to have been assembled in a notebook.[1]

(3) **A supposed notebook.**—The aims of the different divisions of the project study may then be represented graphically by the following diagram (fig. 3) of such a possible notebook. The dotted vertical line indicates the binding of two notebook pages which lie open and are ruled as if a single broad sheet. Notebooks so ruled are now in successful use. The diagram is not drawn to scale. The subject matter below the headings is explanatory of the several kinds of knowledge the pupil would find and record.

[1] Notebooks should, of course, be kept by every pupil; or, if not kept in notebooks, the record of his findings from his project study should be kept by the pupil on cards, filed back of tab cards bearing appropriate project titles. The agent of the board of education for agricultural education assists Massachusetts instructors in the use of the card method, if this is preferred and his help is desired.

8. APPORTIONMENT OF PROJECT STUDY, TIME, AND MATERIALS.

(1) **Diagram column widths.**—The relative widths of the above columns may be considered indications of an approved apportionment of time among the three kinds of subject matter for the most capable pupil. The first column represents the least requirement any pupil should be expected to meet in order to justify his retention in the class. The first and second columns represent requirements most of the pupils should be expected to meet.

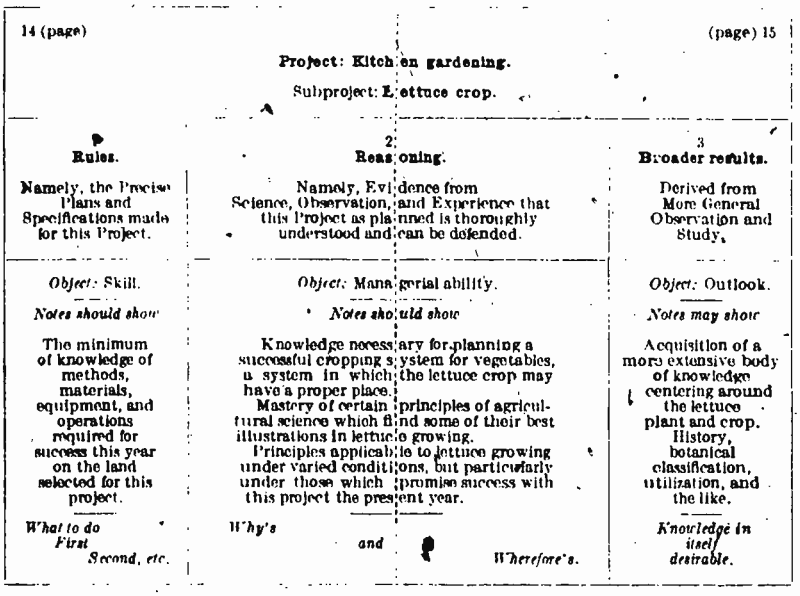


FIG. 3.—Diagram of project study record.

(2) **Faculty cooperation.**—At least three-fourths of the most capable pupil's time should be occupied by the subject matter of columns 1 and 2. Column 3 might well be covered, particularly in the later years of the four-years' course, by special exercises given the most capable pupils by other teachers, such as teachers of botany, chemistry, physics, mathematics, drawing, or English.[1] Close cooperation between these teachers and the agricultural instructor should further this end.

(3) **No pupil "held back."**—In order to direct the project study of his class in the most competent manner, the instructor must of course organize his teaching materials in advance in accordance with two, at least, of the three divisions of knowledge above described. If he

[1] For a suggestive diagram showing possible correlation of elementary school subjects with school gardening, see the insert sheet, opposite page 294, of "Among school gardens," by M. Louise Greene (Agricultural Project Bibliography. Entry No. 852.)

can provide materials of all three kinds, he will have the satisfaction of knowing that the same amount of time may be devoted by the entire class to study related to such a subproject as lettuce production, and yet that no pupil will be "held back" by any other pupil—a result most devoutly to be desired in all forms of teaching.

(4) **First column, first in fact.**—It should be emphasized, further, that the first concern of the least capable should be equally the first concern of the more or most capable. The movement of project study should begin at column 1. The movement should be from left to right, across the field represented by the foregoing "Project study record" diagram—not, as has too often been the case in the study of agriculture, from right to left.

(5) **High school half days, spring and fall.**—Probably the most difficult school schedule problems will be encountered in the high-school vocational agricultural departments. It will be borne in mind that half the school time during the fall and spring terms is to be spent on agricultural project work and study. It is desirable that this entire allowance, when spent away from home, shall be spent in the room with, or under the direct supervision of, the agricultural instructor.

(6) **More mature and less mature minded.**—Diagrams showing how the less mature-minded group and the more mature may be worked to good advantage during the high-school department strictly agricultural half days follow.[1] (See figs. 4 and 5.)

The younger group is assigned to the agricultural instructor forenoons. Parents of these pupils or their other teachers will be responsible for their afternoons. In these departments, where the entire enrollment should not exceed 20, the pupils may generally be divided into two groups of about equal numbers. Since some of the more mature have already been attending high school, where there is but one session, and have started on morning studies, two of which they may desire to continue, the older pupils have been assigned to the agricultural instructor afternoons.

(7) **Project study versus agricultural survey.**—It will be noticed that most of each half day, and, when occasion demands it, the entire time, is definitely assigned to project work or to study related thereto. The project work will be continued during the summer, with school supervision. The project study will be completed in the fall and spring terms; except that during the summer there will be much reviewing, in field and barn, of facts and principles, some noting of new facts as a basis for the further study of principles, and careful daily-record keeping of the expenses and receipts of the projects conducted.

[1] These diagrams may be found suggestive in schedule making at separate agricultural schools, where the project study method is followed.

(8) **Class focus.**—The horizontal cleavages set off the first and last periods—periods which have this in common, that for the time being there is in each period some single focus of attention for the entire class. Here the methods are those with which all are familiar in class recitations or discussions.

Periods.[1]	Forenoon group: First and second year students.
	Agricultural survey (elementary): *About 75 periods.*
9.00 to 9.45	*Object:* General study of agricultural production and rural life. *Textbook:* "Beginnings in agriculture," by Mann. Put emphasis on soils and plant life portions in year for horticulture; on animal portions in year for animal husbandry. Give much attention to suggested problems. *Omit* this agricultural survey exercise whenever the entire forenoon should be devoted to productive work, or to library, laboratory, or other instruction bearing directly upon that work.
	Project work or project study: *About 300 periods.*
9.45 to 11.15	*Object:* Execution of home or school productive projects undertaken by the individual students, coupled with laboratory, library, and other study and observation directly bearing upon those projects. *Concerted attack* by the entire class on plant projects in even years (1912, 1914, etc.), and on animal projects in odd years (1913, 1915, etc.). *An extra project* in animal husbandry may be undertaken in an even year by special arrangement with the instructor; as, also, one in horticulture in an odd year. *Reference books and bulletins*, including agricultural laboratory manuals, will help be consulted according to the ability and needs of the individual students. *Notebooks*, carefully kept, will set in order the ideas and plans derived from this individual instruction for guidance in carrying out individual projects. *Method:* Minimum of class instruction; maximum of personal individual guidance. The instructor will go from student to student, as does the teacher in shopwork, laboratory, or drawing room.
	Project work or project study (*Continued*). **Class discussion of individual projects:** *About 125 periods.*
11.15 to 12.00	*Object:* To subject individual ideas and plans to the criticism of the entire class, and thus to clarify principles and intensify impressions. *Round-up of opinion:* The value of closing each forenoon with this class discussion grows out of the fact that though each has been working on his particular project, all have been working upon the same sort of project, at the same time; as, for example, lettuce as a kitchen garden crop. A device for making all acquainted with what each is doing, and showing that general rules must often be modified in order to meet local needs. A means for developing the managerial type of mind.

FIG. 4.—Diagram of agricultural project periods for selected high schools in fall and spring terms.

(9) **Individual focus.**—The vertical cleavages of the middle periods may serve both to indicate and to emphasize the individual study of each pupil, the careful and the exclusive attention given to the needs of each pupil by the instructor, the adaptation of general agricultural principles to the peculiar home farm requirements and facilities of each particular boy in the class. Here the methods are those which have their closest parallels in customary school "labo-

[1] Periods may be of the same length as those of any particular school. Reserve the first for the "Survey," the last for the "Round-up," and the body of morning for individual instruction. Periods on projects in summer will be determined by the work undertaken, and will be covered by daily time sheets.

ratory" instruction, whether in drawing room, shop, library, or science laboratory.

(10) **Prime merit of this apportionment.**—It is one of the most important merits of this project or part-time plan that the instructor is thus able to deal with the particular needs and capacities of individual pupils and at the same time maintain close, efficient, and progressive class organization and control.

Periods.[1]	Afternoon group: More mature minded students.
	Agricultural survey (advanced): *About 75 periods.*
1.00 to 1.15	*Object:* General study of agricultural production and rural life. *Textbook:* "Elements of Agriculture," by Warren. Vary emphasis in alternate years to accord with subject matter of project work. View local conditions in light of text. *Omit* this survey exercise whenever the entire afternoon should be spent in project work or in observation or study directly related thereto.
1.15 to 3.15	**Project work or project study:** *About 300 periods.* *Object:* Execution of home or school productive projects, coupled with library, laboratory, and other study and observation directly related to those projects. *Concerted attack* by the whole class upon animal projects in even years (1914, 1916, etc.) and on plant projects in odd years (1915, 1917, etc.). *An extra project* in horticulture may be carried out by special arrangement with the instructor, in an even year; or, in animal husbandry, in an odd year. *Reference books and bulletins,* including agricultural laboratory manuals, will here be consulted, according to the ability and needs of the individual students. *Notebooks* will be carefully kept, for setting in order the ideas and plans derived from this individual instruction for guidance in executing the projects undertaken for profit by the individual students. *Method:* Same as in forenoon for first and second year students.
3.15 to 4.00	**Project work or project study** (*Continued*). **Class discussion of individual projects:** *About 125 periods.* *Same purposes* to be served here as in corresponding period for less mature group. (See last period of forenoon.)

Fig. 5.—Diagram of agricultural project periods for selected high schools—Concluded.

9. VEGETABLE-GROWING PROJECT STUDY.

We have seen that vegetable growing is among the projects assigned for first or second year study. The pupil brought up on a farm is likely to bring to the classroom considerable familiarity with several kinds and varieties of vegetables. It remains for his agricultural instructor to amplify his knowledge and experience to the fullest possible extent.

Chapter III gives suggestive outlines for vegetable growing, together with a brief preliminary discussion of various possible classifications of vegetables and a list of vegetables successfully grown in Massachusetts home gardens. It is therein stated that

[1] See footnote on preceding page as to length of periods and number of summer periods. Same rules to apply to more mature as to less mature students.

probably it will be feasible in most cases for the pupils to undertake to grow 11 varieties, illustrative of the 11 groups of vegetables which may be distinguished from the very practical point of view of their methods of cultivation.

The requirements and tastes of most families will probably make it easy to secure the consent of parents to the growing of this number of varieties in sufficient quantity for the home supply. In addition each pupil should be encouraged to grow at least one variety on such a scale as to provide a surplus for sale as a cash crop.

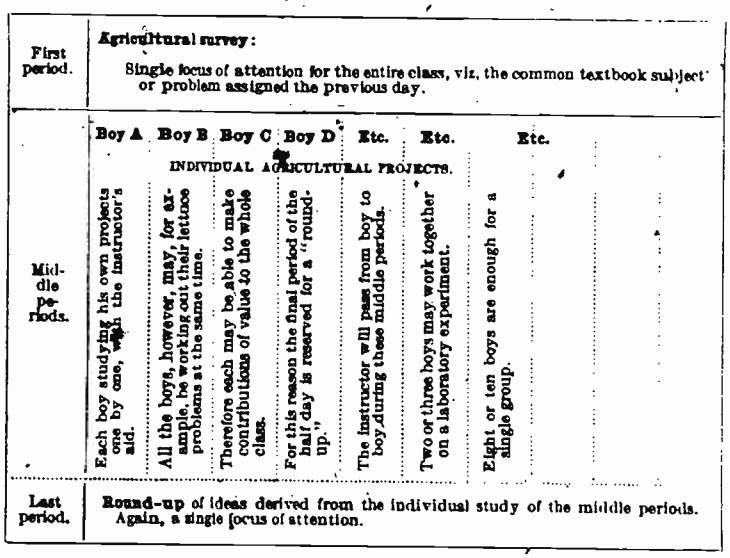


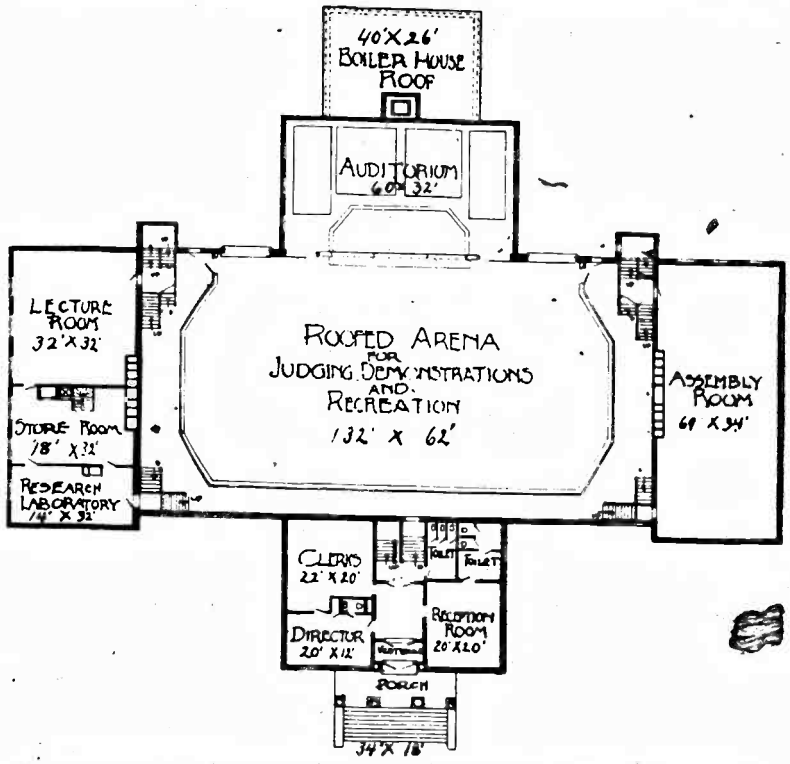
Fig. 6.—Another diagram of the agricultural half day.

The pupil may be helped at will in the actual work of his vegetable growing by members of his family, by exchanging work with fellow pupils, or by hired labor. It is essential, however, that he himself, with, of course, the aid of his agricultural instructor, shall plan his project and manage it; shall be taught and shall attain proficiency in every phase of the actual work of his productive enterprise; and finally shall render an accurate account of all expenditures and receipts in connection with his undertaking.

In vocational training the economic aspects of the projects carried out by pupils are of the utmost importance both as to manipulative skill and as to sagacity in management. Work, use of teams and tools and such materials as stable manure, for which cash is not paid, should therefore be charged at fair valuations against the projects; and all products, whether furnished the family, given away, or sold, should be credited to the projects at current retail prices. The suggestive outlines in Chapter III include questions on the economic elements of project study.

A. HADLEY BOYS HELPING EACH OTHER AT CORN HARVEST.

B. COACHING HADLEY STOCK-JUDGING TEAMS.



A. PLAN OF BUILDING AT SMITH'S AGRICULTURAL SCHOOL, NORTHAMPTON, MASS.

B. ARENA AND AUDITORIUM, SMITH'S AGRICULTURAL SCHOOL, NORTHAMPTON, MASS.

10. SMALL-FRUIT-GROWING PROJECT STUDY.

The best home gardens are seldom considered complete without an abundant supply of small fruits, such as blackberries, raspberries, gooseberries, currants, and strawberries. Grapes also are sometimes included. The small fruits are often found in the same inclosure with the garden vegetables. When we add that the garden is generally most convenient if located near the house, and that all of these small fruits, save strawberries, are tall or moderately high growing, we have said about all about them that can be said in general for assistance in garden planning.

Farm boys are more or less familiar with the above facts. Following, therefore, the making of the preliminary garden sketch, which should show intention of growing one or more small fruits, the small-fruit project study will best deal with individual varieties and be guided by outlines like those suggested for varieties of vegetables.

11. BEEKEEPING PROJECT STUDY.

Beekeeping is an interesting and profitable side line in well-balanced farming. It is particularly important where any considerable attention is given to fruit and vegetable growing. It is therefore a worthy project for first or second year pupils.

Every agricultural pupil should be taught the importance of bees in their relations to economic plants, and their nature and possibilities as economic animals. So much knowledge will be included in the general study of agriculture by both the younger and the older pupils during the periods set apart in the foregoing diagrams, figs. 4 and 5, under the designation "Agricultural survey."

Every vocational agricultural school and department should own, work with, or have access to at least one hive of bees. Undoubtedly certain pupils will desire to conduct beekeeping projects. Project study outlines should be prepared for them, and should cover at least two of the three kinds of project knowledge before discussed.

Since pupils are not to be required to conduct projects in every field covered by the published course of training, beekeeping may be looked upon as one kind of project from which, at their desire or at the discretion of the instructor, pupils may be held exempt.

12. POULTRY-KEEPING PROJECT STUDY.

The study of poultry keeping has been pretty fully discussed as to ways and means, and its desirability and feasibility have been set forth with considerable detail in a previous report.[1] It may

[1] Board of Education (Mass.), seventy-fourth annual report, for 1909–10, pp. 236–240; also "National Society for the Study of Education," eleventh yearbook, Pt. II, pp. 38–40.

safely be urged that every pupil should be permitted, and even required, to conduct a poultry project.

Project study outlines of the sort suggested for vegetable growing will be just as necessary here as elsewhere for the proper guidance of the poultry project pupils.

13. SHEEP AND GOAT HUSBANDRY PROJECT STUDY.

Sheep and goats in some localities are objects of keen interest and economic importance; in other localities they are not.

As to general knowledge and possible exemptions, what was said of beekeeping should apply equally here. Projects should be permitted when strongly desired; and, when permitted, properly guided by appropriate project study outlines; they should not be required.

14. SWINE HUSBANDRY PROJECT STUDY.

Swine husbandry should, probably, in most cases be ranked as nearly equal in importance to poultry keeping—perhaps midway as school projects between poultry keeping and beekeeping. Projects in this field should be optional with the individual pupils. Some knowledge of swine husbandry will be had through the agricultural survey study and its attendant trips for observation.

Where the home farm conditions are at all favorable, swine projects should be urged and outlines for their proper study provided.

15. ORNAMENTAL PLANTING PROJECT STUDY.

Few good farmers are entirely heedless of the attractive appearance of their farm property as farm homes. Some attention should be given by every agricultural pupil to such ornamental planting as is appropriate under reasonably thrifty farm-home conditions. During at least one year of his course, along with his utility projects, every boy should carry a project devoted to the beautifying, in at least some slight measure, his home surroundings.[1]

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[1] List of ornamental plants successfully used at Smith's Agricultural School, Northampton, Mass.:

Annuals.

Marigolds (African).
Marigolds (French).
Zinnias.
Nasturtiums.
Calliopsis.
Candytuft.
Salpiglossis.
Centaurea.
Eschscholtzia (California poppy).
Mignonette.
Asters (Semple's branching).
Portulaca.
Nicotiana.

Shrubs.

Berberis Thunbergii, Japanese barberry.
Cornus Sibirica, Red-twigged dogwood.
Forsythia suspensa, Yellow bells.
Ligustrum Regelianum, Regel's privet.
Lonicera Morrowi, Morrow's honeysuckle.
Lonicera tatarica, Tartarian honeysuckle.
Philadelphus coronarius, Syringa.
Pyrus Japonica, Japanese quince.
Rhus typhina, Staghorn sumach.
Rhus glabra, Smooth sumach.
Ribes aureum, Yellow currant.
Rosa rugosa, Japanese rose.
Sambucus Canadensis, Elderberry.
Spirea Von Houtei.
Spirea *Thunbergii*.
Spirea *callosa*.
Physocarpus opulifolius, Ninebark.
Syringa vulgaris, Lilac.
Viburnum opulus, High-bush cranberry.
Aralia spinosa, Hercules club.

[Footnote continued on next page.]

Some study will have been given farm-home attractiveness during the periods devoted to the "agricultural survey." Good home project work, however, will be as dependent here as elsewhere upon project study outlines carefully adapted to each pupil's home conditions.

16. THIRD-YEAR AND FOURTH-YEAR PROJECT STUDY.

The project study method is identical for all years. When, therefore, pupils now beginning vocational agricultural training have progressed so far in the course as to be prepared for it, third-year and fourth-year project study should be provided for in the manner above indicated. Project study outlines for fruit growing, including orcharding, should be drawn; outlines, also, for the handling of certain vegetables from the market gardener's point of view, and for dealing with the serious problems of dairying.

Every advantage in this outline making should be taken of the opportunities thus afforded for the thorough reviewing of the basal principles of plant production and animal management already dealt with in the project instruction of the two previous years. This reviewing should insure a consistent and closely knit body of knowledge supported by the practical applications of that knowledge. It should, also, make it possible for an older boy who has had good farm experience to enter the course to advantage at the beginning of the third or even of the fourth year.

The field of study one year here, as earlier in the course, should be restricted to and concentrated upon plant projects, and the other year centered upon animal projects.

[Continuation of footnote from preceding page]

For cuttings.

Hardwood:
- Spirea Von Houtei.
- Spirea *Thunbergii*.
- *Syringa vulgaris*, Lilac.
- Privets.
- Forsythia.
- *Philadelphus coronarius*, Syringa or Mock orange.
- *Rhus typhina*, and *glabra*.

Green:
- Geraniums.
- Salvia.
- Rex begonias, for leaf cuttings.
- Cannas, tuber cuttings.

Herbs.

Dill, Thyme, Lavender, etc.

Vines.

Cinnamon, Virginia Creeper, *Ampelopsis tricuspida*.

Bulbs.

Indoor forcing and outdoor use:
- Narcissus.
- Tulip.
- Hyacinth.

Miss S. M. Weed, instructor in ornamental planting at the Northampton School since 1908, makes the following observations regarding the above lists:

"Any of the flowering plants listed are easily grown at home. Choice and range of plants for home gardening depends entirely upon the resources of individual pupils—amount of land available, location, nature of soil, etc. An assortment of from 6 to 10 varieties is about the number most profitably cared for by the majority, but, as I have stated, this number varies greatly.

"As an incentive to home work might be mentioned starting plants at school, to be taken home for use later. Asters, cosmos, and pansies are good plants to use in this way. It is also an advantage to have on hand seeds of standard quality and kind which pupils may buy from the school, thus insuring the use of good seed."

The method of procedure is believed to have been elucidated with sufficient clearness in the foregoing discussion and in chapter III, containing suggestive project study outlines for vegetable growing, so that its application to third-year and fourth-year project study need not at this point be further elaborated.

17. PROJECT STUDY VERSUS SUBJECT STUDY.

Critics familiar with the curricula and methods of teaching common to most public schools of secondary grade have remarked a radical difference of method between subject teaching and teaching by projects. Fear has occasionally been expressed that the project innovation in educational methods may, apart from the skill it gives, result in putting the pupil in possession of merely a more or less incoherent collection of knowledge fragments.

(1) **Subject study.**—*A. Organized knowledge.*—Subject study, it is urged, puts the pupil in possession of coherent bodies of organized knowledge. Subject study, moreover, it is pointed out, so far, at least, as it is of the more modern type, takes into account the environment of the pupil; and the practical bearings of his education, so far as it has any, are thus made plain to his understanding. Subject study stops short at this point. For applied knowledge as such it recognizes no responsibility.

B. Deferred values.—Having been schooled in terminology and principles, also in orderly and efficient habits of reasoning, and having been led to make certain laboratory and other observations as to the applications of principles in the work-a-day world, the pupil must then be trusted to develop efficiency on his own account in one or another field of applied knowledge. The principal values properly to be expected from subject study, therefore, have been termed "deferred values."

C. Agriculture and subject study.—Agriculture has generally been taught by the subject method.[1] A part of the farm boy's year, usually the summer, has been spent on his home farm; another part of the year, usually the winter, or the months of the customary school year, has been spent, in most cases at a considerable distance from his home farm, at the agricultural school or college. In the former, his attention has been devoted to productive agricul-

[1] Following is the list of subjects found in the undergraduate course of training prescribed for prospective teachers of agriculture by one of the most prominent agricultural colleges. With the subjects are given the hours required for each. The significance of this list is found in the tendency for beginners in teaching to be imitative, to try to teach by the very same methods by which they themselves have been taught.

Agronomy	21	Thermatology	2½	English	4
Animal husbandry	16½	Botany	6	Rhetoric	9
Dairy husbandry	8	Chemistry	15	Economics	2
Horticulture	15½	Entomology	2½	Education	8
Secondary school agriculture	6	Zoology	5	Library science	2

ture; in the latter, to agriculture as more or less divided bodies of organized knowledge.

D. The unaided farm boy.—To the farm boy himself, alone and unaided by the supervision of his agricultural instructors, has been left the educational task, well-nigh impossible, under such circumstances, of bringing these elements of his experience—one concrete, the other abstract—into efficient relations, whether for purposes of intelligent understanding or for purposes of economic returns, with the result that the anticipated values of such subject study have too often been deferred indefinitely.

E. Education in forgetting.—Judging from the experience of many pupils, and among the number not a few who have gone on to college, much secondary education by the subject method might justly enough be called "education in forgetting." In fact, it has sometimes been argued that the educational process, as a process, as a means of developing mental alertness, acuteness, and power, is the main concern of the subject-study method; that the forgetting is to be expected, is not to be too much deplored.

The structure and habits of the human mind and brain are such that, following the psychological laws of segmentation, unused knowledge tends to be "forgotten." Much, a vast deal, of the subject matter turned over and otherwise dealt with by the subject-study method is of such a nature that in out-of-school hours and in after-school years it remains unused. To the extent that it remains unused, its forgetting, save by minds supported by the most unusual brain substance, is inevitable. Whether to be deplored, therefore, or not, it has over and over again been observed that examinations once passed and the school year ended subjects are forgotten.

F. Subject-study merits.—For the training of the so-called "abstract-minded" boy, of the boy naturally gifted with a retentive cerebral organism, and of the boy who is to follow a professional as distinguished from a productive career, the subject-study method must be conceded appreciable merits; and these merits become the more pronounced and permanent in proportion as the method, in its dealing with materials and principles, is strongly inductive.

(2) **Project study.**—*A. Accompanied by subject study.*—Merits conceded subject study, however, are not to be subtracted from the total merits of vocational education. The training of the boy who desires a vocational agricultural diploma includes, as we have seen, the subject study of English, history, civics, botany, chemistry, and general agricultural subjects, such as soils, tillage, and crop rotation. That this subject study does not precede but accompanies or follows the boy's project study directly and decidedly enhances its value.

B. Organization of common sense.—a. Induction and application.—But project study has merits peculiarly its own. No more diligent

or effective application of the inductive method in education has ever been witnessed than that proposed, and in good measure already practiced, by the project study of agriculture. The educational cycle is not left open, but is here completed. The movement, from observed data of agricultural production to general laws and principles, is followed by the reverse movement, which is embodied in the application of the laws and principles of science—embodied, that is to say, in economic agricultural enterprises conducted by the pupils on their home farms under competent school supervision.

b. Personal economic interest at stake.—Mr. Huxley's favorite definition of science is understood to have been "organized common sense." The project-study method consists not so much of the conning of "science" already organized and brought to the boys in books as it consists of the actual organization anew of the common sense required for successfully controlling the personal affairs and economic fortunes of the pupils themselves. The "career motive" is here dominant, inspiring, compelling. Upon the organization of common sense is put a strong, personal premium.

c. Natural *versus* artificial units.—The units of project study are not the units of another man's career nor of another man's book. They may, nevertheless, consist of findings from many sources, including picked careers and selected books.

Olericulture may be made a subject study; so, also, may chemistry. Rarely, however, does the subject study of chemistry, for example, include all of chemistry. The limits set are arbitrary.

The lettuce crop to be produced by the pupil in a given year is a project-study unit. As such it requires mastery of certain portions of both olericulture and chemistry. The requirements for producing the crop under the known home conditions mark the limits of this unit. These limits are not artificial; they are natural. The kinds of knowledge to be gained have been indicated above by the suggested contents of the boy's project-study record. The boy's knowledge may be complete for its purpose—an organized unit, a body well articulated and thoroughly comprehended.

The project method deals with natural units. By this method the boy's common sense is focused, clarified, and put directly to important economic tests.

d. Project-study units and pure science data.—Project study, moreover, will probably prove to be one of the most effective means of accumulating first-hand data for the successful study of science as science. The lettuce plant, for example, thrives best in almost any garden soil when fed freely one particular kind of plant food, namely, nitrogen. The pupil must therefore know this raw material of chemistry, not at the outset in its every form and use, but in the special form best suited to the needs of the lettuce plant. He may

learn to think and speak of it by the symbol the chemist has assigned it. That symbol will then have been learned once for all. Later, in other project study, he will learn more about nitrogen in its relations to productive agriculture. One by one, if wisely taught, he will similarly come to know other elements of plant or animal food, together with their symbols. He will come to know them in an intimate, personal way, by name and symbol, by appearance and action. All this will surely be gain, and not loss, if later the boy has opportunity for studying these chemicals in their more general relations.

e. Education in remembering.—The knowledge which is the boy's quest in project study is knowledge of which he sees the need. Being needed year by year, it will year by year be recalled. Used again and again, added to, modified, and exactly applied, it will tend to be distinctly remembered.

If unused knowledge tends to be forgotten, the converse is most emphatically true. Used knowledge tends to be remembered. The primary pursuit of project study as the accompaniment of project work is the organization of definite and coherent bodies of knowledge which the recurrent seasons will naturally and of necessity call into use. Forgetting here is a hindrance. If it occurs, it is not a virtue but a fault.

In short, the organization of common sense by the project-study method is not education in forgetting; it is education in remembering.

f. Traditions of success versus traditions of defeat.—Educators and public-spirited people in general are gravely concerned over the yearly exodus from school of the army of children whose schooling is halted as soon as the compulsory-education laws release them. But why should they not go out?

In a vast proportion of cases their lot in school has been far from happy. The "bookish" boy has been, and may always be, the exception and not the rule. Taught by one sort or another of subject-study method, and failing to see, much less to feel, direct relationship between what they have studied and what they are likely to be and do in life, too many have "failed in their studies." Their school traditions have been traditions of defeat.

If anything can efface the depressing memory of such traditions, by establishing traditions of school success, it is believed that the project method of vocational education can do it. And probably no field for this is more favorable than that of agriculture.

Boys, especially farm boys, like the open. They are curious about plants and animals. They readily come to know them. They like to possess them. When school begins in the open and ends there; when in the schoolroom are found undreamed-of guide books to more wonderful and intimate understanding of the already

familiar objects of the open; most of all, when the school teacher meets the boy where his interest is keenest, and shows him how to turn his possessions, or those of his father, to better economic account—then schooling becomes a new experience to the boy. It becomes part of his life, not something apart from it. Traditions of success in school become possible of attainment. They become for the majority inevitable. Than this, project study can, perhaps, hope to achieve no finer result.

18. PROJECT STUDY PERSPECTIVE.

Looking back, now, over the project and part-time plan of vocational agricultural education, as analyzed and expounded in the report on "Agricultural Education" of the board of education to the Massachusetts Legislature of 1911, and in the present discussion, two facts should stand out in clear relief. Certain kinds of projects are elective; others are prescribed. Each of these two sorts of projects reveals the relative proportions and importance of the other.

(1) **"Improvement" and "experimental" projects desirable.**—The projects termed "improvement" and "experimental" offer excellent incentives to project work and to project study.

The first may contribute most toward the training as a whole by being confined to projects which appeal to, and tend to develop, the pupil's sense of attractiveness, order, and fitness, in farm-home appointments and surroundings. These will touch his pride.

The second may make its best contribution by appealing to, and nurturing, the element of daring—the tendency of youth, even at some personal risk, to get out of ruts. Appropriate projects for the second are to be found by following the best leadership in animal and plant feeding, in plant and animal breeding, in selection of plant and animal foundation stock in the light of comparative records of production, and the like. Such projects will arouse his courage.

Both will have pronounced values as elements of vocational agricultural education, for both will be directly aimed toward a more favorable farm inventory and toward considerably increased farm profits. Both, moreover, may be made to contribute as much to community as to private betterment and well-being.

(2) **"Productive" projects fundamental.**—First and without fail, however, in vocational education should come the projects termed "productive."

The scale of the improvement and experimental projects may be modest. The scale of the productive projects must be extended, occupy as much as possible of the time and engage as much as possible of the energy of the pupil. Entering upon a productive project should be an indication of the pupil's determination to go just as far as he can in any given year, not only toward learning how to

become a self-respecting and self-supporting producer of farm products, but also toward putting that knowledge into practice.

Vocational agricultural education, in short, means, if it means anything, the constant interworking of ideas and action. It means the educational unity of two practically simultaneous processes, the processes of *earning* and *learning*.

The logic of making the productive projects fundamental is the logic of life. First, man must provide his subsistence; next, a surplus for barter, sale or other use. Then out of his surplus he may rightfully take risks, or make nonproductive investments of time or capital. And this holds true no matter how slight the risk, nor how modest the nonproductive outlay.

Happily, projects primarily productive, involving, as they must do, considerations of quality no less than those of quantity, are not without vital elements of training in attractiveness, order, and fitness. Moreover, the boy's success in his enterprises aimed at profit is more than likely to be directly proportionate to his daring enlistment under the leadership of the newer agriculture. Productive projects alone, therefore, may contribute to the education of the pupil something of those elements which are the more direct aims of projects termed "experimental" and "improvement."

The agricultural instructor, in laying out or in approving projects to be undertaken by his pupils, will, therefore, make no mistake. His primary concern must be vocational agricultural education, through productive projects. Productive projects may, in any given year, and at a pinch in all years, be taught to the exclusion of all others. "Improvement" and "experimental" projects, where found feasible, are desirable. "Productive" projects are fundamental.

19. SUGGESTIONS FOR THE AGRICULTURAL INSTRUCTOR.[1]

(1) **Projects.**—Suit the size of the project to the capacity of the pupil. Then require good work.

A. Not too small.—Speed up the boy's work by making his project big enough to require attack and dispatch for its competent execution. Make it so big as to avoid all tendency toward habits of dawdling and pottering. Let it be big enough to arouse his enthusiasm by making the profit he may reasonably expect to get appeal to him as being a real prize. Make the project big enough so that a competing job shall not get the boy away from school. In short, let each boy's project be such that it shall serve, not an avocational but a vocational end of commanding importance.

B. Not too big.—At the same time do not permit a boy to undertake more than he can carry out in a thoroughly workmanlike manner.

[1] These suggestions were, of course, addressed directly to the vocational-agricultural instructors in Massachusetts. It may be remarked that these men are showing excellent ability in putting them into effect.

If slow work is likely to be finical, fussy, and uneconomic, slovenly work is discreditable. Good habits of work should be formed and bad habits either avoided or sharply corrected. Projects just within the grasp of the boy may be, and should be required to be, capably carried out.

(2) **Project clothes.**—Require that all project work shall be done in working clothes. Provide lockers for the ordinary school clothes and shoes, and require a change of dress when project work is to be done on the school premises. Provide, also, conveniences for cleaning up after the work is done.

This should be looked upon as a perfectly reasonable rule the nonenforcement of which would be absurd and must make the project work appear ridiculous.

Require, also, that jumpers and overalls shall be regularly laundered and decently kept.

(3) **Project records.** *A. Work records.*—Require exact records of work done; also, of all other items of outlay and income. Require that these records shall be made on the form approved by the board of education, and that the daily detachable sheet shall be handed in at the first school session following the day when the work is done, or any other items recorded.

Preserve these daily records for such inspection as may be made, or for such summarized reports as may be required, by the agent of the board for vocational agricultural education.

B. Study records.—Require evidence of project study in notebooks kept by the pupils. The form of notebook suggested above has the merit of keeping steadily before the eyes of the pupil the kinds of project knowledge with which he is dealing and their relations.

Another form of notebook may be found more useful to the instructor and about equally good for the pupil. This form, also, is now in successful use. The right-hand page in this case is reserved for materials found by guidance of the second column of the project-study outline. The left-hand page is divided into two about equal columns. Of these, the first is used for the working rules, or plans and specifications of the pupil; the second, for the authorities consulted, whether in print or in person. When the instructor desires to assign a pupil new references, he finds it very convenient to be able to review at a glance, in the column specially reserved for them, the authorities already consulted.

The particular form of notebook, however, is but a means. The desired end is clear evidence of sound thinking. The pupil, in some form of notebook, should be required to reduce his approved agricultural ideas to writing, because this will be one of the best forms of evidence that his training is placing such ideas at his command.

The agent of the board will desire to inspect these project-study records of the agricultural pupils; but, quite apart from their value

as evidence for State aid, these records should be kept with such care as to be of permanent value to the pupils themselves in their future unsupervised farming projects.

C. Photographic records.—Use a camera. Records by photographs are convenient. They may be readily filed and compared. For printed reports or public exhibitions they are interesting evidence of work done; and as evidence of equipment, methods, and results they are, when taken by the supervising instructor, both illuminating and convincing. The eye of the camera is faithful. Credit is given where credit is due. The eye of the camera is also inexorable—it neither condones nor forgives.

Home surroundings, for example, may in one respect or another be bad, yet the instructor's photograph may be the first vivid means of showing the boy his home as others see it—his home as it is. On the photograph, or by its aid, the boy may select modest projects for improvement which are to be carried out within the first year; others, within the succeeding years of his school course. Later photographs will show that he has done what he planned to do toward making his home what, at his hands—considering the boy's age, strength, and resources—his home ought to be.

In many neighborhoods the best types of live stock, for another example, can only be shown the pupil by aid of illustrations in farm papers or in books. It will add not a little of interest and value to the instruction of the pupil if, in addition to comparing, for example, the boy's best cow with the highest record queen of her breed and type, as shown in a book or paper, a photograph of his cow taken from the same point of view as that of the illustration be placed side by side for comparison with that of the queen. The boy may thus be made to see the more vividly what to work toward in his future buying or breeding. Photographs of farm products of unusual excellence may endure long after the products themselves have been sold or consumed, and may afford the only means of comparing the form and appearance of products one year with those of earlier or later years. For educational purposes such photographs add vastly to the value of records dealing with types, yields, and comparative results in farm production.

The architect uses a camera for record of the ground on which, and of the surroundings among which, his proposed building is to be placed. The landscape architect uses a camera in order that he may the more effectively work from existing grades, contours, and planting to the final grouping of trees and shrubs, contours and grades which his design will establish. Even in athletics the crew and football coaches find the camera a faultfinder and a praise-bestower more convincing on one hand, and more inspiring on the other, than their strongest words. The traveler records now in

photographs more often than in journals the things he has seen and done. Camera records are widely valued.

If the camera may be an inexorable revealer of agricultural faults, it is evident that it may also be made a faithful revealer of agricultural virtues. In short, a camera, used in connection with each boy's instruction from the beginning to the end of each boy's course, must be looked upon by the sympathetic instructor as one of his most important aids, not merely in faithfully recording the home progress of his pupils, but also for inspiring and sustaining the highest order of project work and project study.

D. Certification records.—Keep a record of each pupil, showing your opinion as to his capacity for planning farm work and his skill in farm operations. Keep the kind of record which would enable you to recommend a boy for a particular job, if he were to leave school before graduation; or for a more responsible job, if he were to complete the full course.

Make a list of the things the most capable boy may be trained to do in matters of farm routine. Then test each boy from time to time, and check to his credit those items on your list for which he shows you that he should receive credit. Include such items as ability to harness a gentle horse, to harness a horse that is notional if not exactly vicious, to harness a pair of horses, and for various purposes; to plow, to cultivate, to mow by hand and by machine, to milk, to cleanse and sterilize utensils, to keep down the numbers of bacteria in milk by care of stable, cows, and his own person and clothing; to prune and to spray; to size, to pack, to store, or to sell fruit and vegetables. Include items as to his habits, such as whether or not he rises early without calling, or promptly when called, is regular, punctual, and reliable in doing chores, is a willing worker, and the like.

Make your certification records progressive. Let them center around the groups of projects published for given years, and advance year by year from group to group. By the end of each boy's course you will thus know from your own observation what each pupil is capable of doing.

Finally, as your knowledge of each boy grows, reduce your record to writing. Put it in a form which may become part of the permanent records of your agricultural school or department. Such a permanent, intelligent, and clear-cut record is due both instructor and pupil.

E. Project bookkeeping.—Require that an accurate account shall be kept of every item of outgo and income, including proper charges for the boy's own labor in connection with every project undertaken by a pupil (see above, pp. 32, 42). Set a proper example by keeping a corresponding account of the productive operations conducted by your school or department.

Require entries to be promptly made, so that at a moment's notice a daily balance, a weekly balance, or a balance from the beginning of any given project may be struck. The project "Daily Report" blanks before mentioned may be made to serve as a "day book," from which the balanced accounts may be made up.

Check these accounts for accurate figuring. Drill may be given by requiring each boy to refigure and check up the accounts of his classmates. Even the drill in mathematics will thus be dealing with going productive enterprises, which, in the end, must show an even balance between expenditures and receipts, a profit or a loss.

(4) **Project outlines.** *A. Ask questions.*—Support, guide, and check the project work of your pupils by appropriate and directly pertinent project study. In organizing your teaching materials, whether found in books, in laboratory experiments or other tests, or in things seen and done outside the classroom, adopt the question method. Avoid to the fullest extent, however, leading questions, questions which suggest an answer "yes" or "no." Ask questions which require study, thinking, and perfectly explicit written or oral replies. Ask questions to which most of the boys ought to find answers. Include now and then a question for your most capable pupil. Begin with questions vital to the success of the projects in hand.

B. Cover the needs of every boy.—By making the outline of questions full enough to cover the project needs of every boy in the class, certain questions may be marked, and others omitted, for individual pupils. A single outline will thus serve the entire class.

Be sure that each boy's project-study record is correct on all points necessary to the success of his particular project. Your questions will thus insure clear thinking, accurate statement, and properly planned work.

C. Make outline overlap outline.—Things frequently and distinctly recalled are best remembered. Study overlapping of reference materials in your outline making as aids to thorough reviewing and to facility in statement. Answers composed with much labor and difficulty at first may thus finally be made easily and promptly. Do not overlap your outlines too often nor too much.

D. Make outline overlap textbook.—Make your outlines not only overlap one another, but also overlap the approved textbooks used for the "agricultural survey" instruction. The pupil's knowledge will thus become well knit. You can hardly make your outlines and your textbooks excessively overlap.

E. Refer to illustrated matter.—Remember that in most cases your boys are likely to be active and practical in their interests and abilities, rather than "bookish." Therefore, in your outline making refer wherever possible to pages which illustrate the points of the

text by diagrams and photographs. You may thus make assurance doubly sure that the pupil shall get the fact or principle which you send him to get.

F. Make outlined study lead to un-outlined.—Of course, a major aim must be so to instruct a boy by formal guidance that he shall, little by little, come to find himself at home among agricultural books, bulletins, and current literature. To be able to find one's own references and information on any given question is an important result of good education.

In connection with the study of certain questions, therefore, ask every boy now and then to find material by consulting the index or table of contents of some book purposely omitted from the project study outline. In like manner require every boy to consult the agricultural papers with particular reference to his project, as these are received from week to week.

Moreover, require each boy to begin the use of a card index covering information of peculiar value and interest to himself; and of a system of filing, and finding again, such notes, clippings, and free bulletins as each boy may be helped to accumulate for his private use and possession.[1] The agent for agricultural education will be glad to advise instructors as to the uses of such an index and file.

Finally, send every boy home every day with a good agricultural book, bulletin, or report bearing on his home project; also, with a definite problem to work out, or a fact or principle to find, which, if it does not require it, shall at least attract to the boy's aid the cooperation of his father or some other member of the household. By this means the boy's interest in his project may be greatly enhanced. Incidentally by this means, also, all members of the family may become participants in the educational work of the department or school. In sending books home be sure to include those which best illustrate, with diagrams and photographs, the matters to be studied and reported upon.

All this will be effective training of the power of the pupils for independent study and for study at home.

G. Prepare outlines ahead.—Devote one-fourth of the day or week in summer to the preparation of outlines for use during the fall term. The period free from teaching and supervision in winter is extended to three months for the express purpose of promoting the professional improvement of the agricultural instructors. Two-thirds of this period is expected to be devoted to this purpose, and, until outlines covering the needs of a given school or department have been pre-

[1] For the purpose of introducing an indexing and filing system suited to farming, the Library Bureau, Boston, has agreed to put together and deliver at cost to agricultural pupils and instructors an outfit which has been used successfully for several years by practical farmers, and is now known by the name "Agricultural Project Study Index and File."

pared, the instructor is counseled to use a large part of this time for making or improving outlines for use during the spring term. Thus the labor of outline making during the actual teaching terms may be reduced and time gained for laboratory and shop preparations.

(5) **Approval and cooperation.** *A. Submit outlines for approval.*—The Massachusetts law requires that State aid shall be based upon approval of methods of instruction by the board of education. It is believed that the most satisfactory plan of approval is that of "approval in advance." Instructors are requested, therefore, to submit their project-study outlines for approval as soon as they are drawn.

Outlines like those suggested in Chapter III, above referred to, are approved. Provisional drafts may be made in duplicate by use of carbon paper or any other distinct duplicating device. As soon as made a copy should be mailed to the agent of the board of education in charge of this training. Provided the outline is like those above suggested, instruction may then proceed in accordance therewith pending receipt of advice to the contrary.

B. Be prepared to meet other instructors from time to time. Conferences will be called, now at one school or department and again at another, where efficient project methods are in operation. By observation and discussion each may profit from the experience of others, and thus the entire service may from year to year be improved. Therefore be prepared to discuss and to demonstrate your best methods and results for the benefit of other instructors when called upon to do so.

C. Cooperate in outline printing.—Considerable variation in the excellence of outlines is to be expected. The enthusiast for poultry keeping may be expected to produce the best study outlines for project work in this field; the enthusiast for dairying, the best outlines for dairying; the enthusiast for fruit growing or vegetable growing, the best outlines for study in these fields; and so on through the several fields scheduled for agricultural project training.

The board of education will from time to time print outlines prepared by individual instructors, or will combine outlines prepared by more than one instructor in a given field and print them. Due credit for such outlines as may be found of sufficient merit for this purpose will be given their authors. The best outlines produced anywhere in the service may thus be made available for the improvement of the service everywhere. The hearty cooperation in outline making of all participants in this new type of teaching will be for the individual benefit of every man engaged in it; and, without any misgivings as to the willingness of any instructor to do his part, such cooperative effort is therefore most strongly urged.[1]

[1] See footnote, Chapter III, p. 57.

As a direct aid to harmony of action and rapid progress, an "Agricultural Project Study Bibliography" has been printed as Bulletin No. 10 by the Massachusetts Board of Education.[1] It is prefaced by explanations and directions as to its use. By adopting uniformly in all the schools and departments the numbers for reference materials therein assigned outlines may be prepared with the minimum of labor, and when printed will be interchangeable and may be used in common. Then, as before suggested, in order to adapt an outline perfectly to the needs of a given pupil, it will only be necessary for the instructor to mark on that pupil's copy the references best suited to his particular productive farm enterprise and powers of comprehension.

20. CONCLUSION.

The suggestions to the agricultural instructor just given may at first sight appear to be counsels of perfection difficult, if not impossible, of execution at the very outset of this new undertaking in State-aided vocational agricultural education.

Nevertheless, in view of the foregoing discussion, they are believed to show the precise direction to which the development of this training should be kept. Furthermore, and finally, by aid of the methods of class organization and individual instruction heretofore proposed, it is believed that the earnest and diligent agricultural instructor will, sooner than he may now expect, find himself capable of carrying out these suggestions exactly and in full.

[1] See Chapter IV for a reprint of that bulletin with the addition of a few new entries.

Chapter III.

PROJECT STUDY OUTLINES FOR VEGETABLE GROWING.[1]

SUGGESTIONS FOR INSTRUCTORS IN MASSACHUSETTS STATE-AIDED VOCATIONAL AGRICULTURAL SCHOOLS AND DEPARTMENTS.

Of admirable agricultural textbooks, reference books, bulletins, reports, papers, and periodicals, there is now almost a superabundance, and the supply is steadily growing.

The principal problem, therefore, of the agricultural instructor, responsible for putting into effect the Massachusetts plan of home-project or part-time vocational agricultural education for boys over 14 years of age, is the problem of making selected portions of this literature available for his particular boys and their particular projects.

The present chapter discusses one field of agricultural project instruction, and this with special reference to the work and study of first or second year pupils. It suggests outlines following which the pupils may prepare themselves directly for their work; and, at the same time, be taught how to gain from all sorts of reference authorities stated items of desired information.

Outlines like those suggested have proved to be useful models. They show the economy in outline making of using numerals instead of titles in referring to reference literature. The heavy-faced numerals are the numbers assigned to certain titles in the "Agricultural project study bibliography," published by the Massachusetts board of education and reproduced in revised form in Chapter IV of the present bulletin. The numerals in lighter-faced type refer to pages.

It was strongly urged that the numbers assigned the titles in Chapter IV be adopted by all the vocational agricultural libraries in Massachusetts, so that, as future outlines were made, these outlines might be interchangeable and serviceable throughout the system.

Outlines modeled after those here suggested, and applied to the various other fields of agricultural project study, are being approved.

[1] This chapter reproduces the substance, but does not exactly reproduce the form, of materials first published as Bulletin, No. 5, 1912, by the Massachusetts board of education.

1. PROJECT STUDY AND VEGETABLE GROUPS.

What number of vegetables may a boy safely undertake to grow? How and in what order should the vegetables he grows be studied? These problems are dealt with in the following discussion:

(1) **Possible classifications.**—A careful study of the botanical characteristics, uses, and methods of cultivation of any considerable number of varieties of vegetables will disclose the fact that vegetables naturally fall into different groups, each distinct in important respects from others.

Vegetables have been classified by their food parts under such headings as the following: "Roots we eat," "Leaves we eat," "Seeds and seed pods we eat." To these three groups might well be added, "Stalks we eat" and "Plants we grow for garnishes."

Vegetables have been classified, also, according to the date of planting or earliness of maturity in the open, as, "first early," "second early," "third early," "fourth early," or "late."

Again, vegetables have been classified according to certain botanical characteristics. Under this classification "early" and "late" vegetables may be found in the same group; also, vegetables in a given group, as, for example, those of the parsnip family (*Umbelliferæ*), may differ radically as to their food parts, and run from roots we eat to edible leaves and seeds. The parsnip family includes even the most important garnish plant. Our garden herbs and vegetables belong to at least 17 plant families.

(2) **Possible varieties.**—The following varieties of vegetables have been successfully grown in Massachusetts home gardens, and are believed to be among those which are suitable for project work and study. The arrangement is alphabetic, and throws no light upon choice of preferred varieties where two or more varieties are given.

Asparagus:
- Giant Argenteuil.
- Palmetto.

Beans, green:
- Bountiful.
- Burpee's Stringless.
- Burpee's Stringless Green-pod.
- Early Red Valentine.

Beans, pole:
- Arlington Red Cranberry.
- Dreer's Improved Pole Lima.

Beans, shell:
- Dwarf Horticultural.

Beans, wax:
- Golden Queen Wax.
- Refugee.
- Wardwell's Kidney Wax.

Beets:
- Crosby Egyptian.
- Detroit Dark Red.
- Eclipse.
- Edmand's.

Cabbage:
- All Seasons.
- Curled Savoy.
- Danish Ballhead.
- Jersey Wakefield.

Carrot:
- Danvers Half Long.

Cauliflower:
- Snowball.

Celery:
- Giant Pascal.
- Paris Golden.

Corn:
- Cory.
- Country Gentleman.
- Golden Bantam.
- Quincy Market.
- Stowell's Evergreen.

Cucumber:
- Arlington White Spine.
- Davis Perfect.

Dandelion:
- Improved French Thick Leaved.

Eggplant:
- Black Beauty.
- New York Improved.

Endive:
- Broad-Leaved Batavian.
- Green Curled.

Kohl-rabi:
- Early White Vienna.

Leek:
- Carentan.

Lettuce:
- Black Seeded Simpson.
- Black Seeded Tennis Ball or Big Boston.
- Deacon.
- Salamander.

Muskmelon:
- Emerald Gem.
- Miller's Cream.
- Rocky Ford.

Onions:
- Yellow Globe Danvers.

Parsley:
- Arlington Double Curled.

Parsnips:
- Abbott Hollow Crown.

Peas:
- Gradus.
- Gregory's Excelsior.
- Surprise.
- Telephone.

Pepper:
- Ruby King.
- Sweet Mountain.

Potatoes:
- Green Mountain.
- Irish Cobbler.

Radish:
- Early Scarlet Globe.
- French Breakfast.

Rhubarb:
- Linnaeus.
- Victoria.

Salsify:
- Mammoth Sandwich Island.

Spinach:
- Long Standing.
- Round Thick Leaf.
- Savoy-Leaved.

Squash:
- Crookneck.
- Early Prolific Marrow.
- Hubbard.

Tomato:
- Bonny Best.
- Chalk's Early Jewel.
- Earliana.
- Stone.

Turnip:
- American Rutabaga.
- Early Milan.
- White Egg.

(3) Classification by methods of cultivation.—The following classification of the foregoing varieties of vegetables is based on essential methods of cultivation and will probably best serve the purposes of project study:[1]

Class I. Annual Vegetables.
- Subclass I. Crops grown for Subterranean Parts.
  - Group 1. Root Crops.
    - Beet, *Beta vulgaris.*
    - Carrot, *Daucus carota.*
    - Parsnip, *Pastinaca sativa.*
    - Radish, *Raphanus sativus.*
    - Salsify, *Tragopogon porrifolius.*
    - Turnip and rutabaga, *Brassica.*
  - Group 2. Tuber Crops.
    - Potato, *Solanum tuberosum.*
  - Group 3. Bulb Crops.
    - Onion, *Allium Cepa, A. fistulosum.*
    - Leek, *A. Porrum.*
- Subclass II. Crops grown for Foliage Parts.
  - Group 4. Cole crops.
    - Cabbage, *B. oleracea.*
    - Cauliflower, *B. oleracea.*
    - Kohl-rabi, *B. oleracea.*
  - Group 5. Pot-herd crops (used for "Greens").
    - Spinach, *Spinacea deracea.*
    - Beet, *Beta vulgaris.*
    - Dandelion, *Taraxacum officinale.*[2]
  - Group 6. Salad Crops.
    - Lettuce, *Lactuca sativa.*
    - Endive, *Cichorium Endivia.*
    - Celery, *Apium graveolens.*
    - Parsley, *Carum Petroselinum.*
- Subclass III. Crops grown for Fruit or Seed Parts.
  - Group 7. Pulse crops.
    - Bean, *Phaseolus, Dolichos, Vicia.*
    - Pea, *Pisum sativum.*
  - Group 8. Solanaceous crops.
    - Tomato, *Lycopersicum esculentum.*
    - Eggplant, *Solanum Melongena.*
    - Pepper, *Capsicum annuum.*
  - Group 9. Cucurbitous or vine crops.
    - Cucumber, *Cucumis sativus.*
    - Melon, *C. Melo.*
    - Squash, *Cucurbita.*
  - Group 10. Corn.
    - Sweet corn, *Zea Mays.*

Class II. Perennial Vegetables.
- Asparagus, *Asparagus officinalis.*
- Rhubarb, *Rheum Rhaponticum.*

[1] The outlines of this classification were proposed a decade ago in "Principles of Vegetable Gardening," pp. 240–242, by Prof. L. H. Bailey, and have been followed in one of the latest studies of the subject, "Vegetable Gardening," 1912, pp. 196–199, by Prof. R. L. Watts.

[2] This is a perennial, but when grown in a garden does not occupy a given piece of ground more than a year.

(4) Varieties of vegetables per pupil. *A. Desirable range.*—Glancing over the above list (2) and classification (3), embracing some 75 varieties and 11 groups, it would appear to be desirable that each boy should grow and study at least one variety from each group. The least number of varieties dealt with would then be 11, and, within certain groups, would permit of a considerable range of choice for suiting the tastes of the boy or the likings of his family.

B. Surplus for sale.—For testing his results by the strictest commercial standards, each boy, in addition to growing certain varieties of vegetables in sufficient quantity for supplying the summer and winter needs of his family, should be encouraged, if not required, to grow at least one variety on such an extended scale as to yield a surplus for sale. If his family were in modest circumstances, and could only allow him credit at current prices for vegetables produced for home use, his surplus might make his biggest crop his only cash crop. It can not be doubted that the prospect of cash returns must be considered a most powerful incentive to competent, persistent, and intelligent project work and project study.

C. Experience as a guide.—Of course there is great variation in capacity for fruitful study and competent garden work; but even children under 14 have successfully produced in school-garden work more than a half-dozen varieties of vegetables; and boys of secondary-school age, when giving only part of their time to such work, have produced, with clean culture and profitable results, fully twice as many.

D. Judgment of the instructor.—It is evident that the number of varieties per pupil must be left to the instructor. He must exercise his best judgment in approving the number, as well as the sorts, of vegetables to be grown.[1]

Where individuals have little or no preference as to the variety within a given group, one pupil may be assigned one variety, other pupils the other varieties. Where there is school land, varieties not chosen for home growing may be grown at the school. Thus the work, study, and observation by the whole class may be made to cover nearly, if not completely, each entire group.

The 6-variety boy should not be permitted to undertake 12 varieties, nor should the boy capable of completing a 12 or 15 variety project be permitted to stop short at a 6.

[1] Mr. J. H. Fay, a teacher of experience in project instruction and home work supervision, thus summarizes the situation as he sees it:

1. The varieties to be chosen should be adapted to the soil, exposure, and location of land on the farm.
2. The varieties should be those most easily grown with success.
3. Use varieties serving the most useful, economic, and instructive purposes.
4. Use those sorts best suited for local sale or home consumption.
5. Aim to have the boy's home gardening supplement and improve the present kitchen garden; or where such does not exist, or is very inferior, make it of such a nature that its value will be realized and permanency secured.
6. If field projects of a commercial nature are the ones in view, then local conditions as to soil, markets, etc., will again determine the varieties to be selected.

2. PROJECT STUDY BY VEGETABLE GROUPS.

(1) **A practical approach.**—Since productive work on the home farms of the pupils is such a fundamental feature of the project and part-time method of agricultural education, there are obvious advantages in the above classification of vegetables by methods of cultivation.

(2) **Aid to garden planning.**—Familiarity with the general cultural requirements of the various groups is necessary to the first intelligent steps in home-garden planning. These requirements are given by various authorities. The following notes are from Prof. Bailey's "Principles of Vegetable Gardening," pages 271–433:

Group 1. Root crops require a cool season and deep soil. They are grown in drills, and usually are not transplanted. They are used both as main-season and secondary crops. All are hardy. No special skill is required in growing them.

The necessity of deep soil is apparent when one considers that the value of a root depends to a large extent on its straightness or symmetry. In hard and shallow soils roots are short and they tend to be branched and irregular. Fine tilth does much to insure quick growth, and quick growth improves the quality.

Group 2. Tuber crops. The potato.—Deeply pulverized cool soil, holding much capillary moisture and rich in potash, deep and early planting, level culture, frequent surface tillage to conserve moisture, spraying to insure healthy foliage—these are requisites of the best potato culture. The potato is propagated by means of tubers. It thrives best in a relatively cool climate; in the South it is successful only as a spring and fall crop, for the midsummer season is too continuously hot.

In most cases a heavy yield of potatoes is largely a question of moisture.

Group 3. Bulb crops.—All the bulb crops are hardy, require a cool season, and moist, rich soil, with a loose surface. Usually they are not seed-bed crops. They are used both as main-season and secondary crops. They are propagated by both seeds and bulbs. These crops are grown chiefly for the underground bulbs (but the leaves are often used in stews and seasonings).

Group 4. Cole crops.—All cole crops are hardy and demand a cool season and soil and abundance of moisture at the root. Except the kales and kohl-rabi, all are seed-bed crops, and even kales are often started in beds. Each plant requires considerable space in order to develop well. Cole crops are grown for the vegetative aerial parts rather than for fruits or roots.

Group 5. Pot-herb crops.—Pot-herb crops, or "greens," are grown for their leaves; therefore they must make quick growth in order to be crisp and tender; the ground must have good surface tilth and much available plant food; the application of soluble nitrogenous substances is usually important, particularly when the growth is nearing completion. Most pot-herb crops demand a cool season, and nearly all of them are partial-season crops, and are therefore treated as succession or companion crops.

Group 6. Salad crops.—As a general statement, it may be said that salad plants require cool, moist soil and a quick continuous growth if the best results are attained. They are often benefited by a special application of quickly available fertilizers during growth, particularly of nitrogen in those species which are desired chiefly for a quick growth of leaves.

Group 7. Pulse crops.—Botanically peas and beans are very closely related, but they have few points in common from the cultural point of view, since peas are hardy, cool-season plants and beans are tender, warm-season plants. Both are leguminous crops, and are therefore capable of using atmospheric nitrogen. As garden crops, however, they may need applications of nitrogen in order to secure a quick start, par-

ticularly if an early crop is desired. "It is frequently the wiser economy to apply nitrogen, particularly if they are raised upon land which has not been previously planted with these crops and thus may not possess the specific nitrogen-gathering bacteria." (Voorhees' Fertilizers, p. 269.)

Peas.—Peas are a partial-season crop, requiring cool season and a soil not overrich; seed is sown where the plants are to stand; grown in drills, hardy.

Beans.—Garden beans represent several species, but all the common kinds are very tender to frost and require a warm season and sunny exposure; seed is sown where the plants are to grow; usually grown in drills, except the tall kinds; the common bush beans are partial-season plants.

Group 8. Solanaceous crops.—Tomatoes, eggplants, and their kin are hot-season plants. They require nearly or quite the entire season in which to mature. Usually they grow until killed by frost, at least in the north, and the production of a heavy crop depends largely on securing an early start. They are seed-bed crops, and they need abundance of quick-acting fertilizers applied relatively early in their growth. They are grown in hills.

Group 9. Cucurbitous or vine crops.—Cucurbitous crops are annuals, grown for their fruits; they are tender to frost; they require a warm season and a full exposure to sun; they are long-season crops, and with most of them a quick start is essential in order that they may mature the crop before fall; they are grown in hills, as a main crop; they are planted in the field or in frames, depending on the region and the period at which the crop is wanted; they transplant with difficulty, and if the plants are started in advance of the season they are grown in pots, boxes, or on sods.

Group 10. Corn (other names omitted).—The plants here mentioned are all warm-weather crops; they are annuals, or grown as such, and they are cultivated for their immature fruits; they should have quick soil; usually they are not transplanted; other than good tillage, no special treatment is required.

Group 11. Perennial crops.—The management of perennial crops differs from that of other vegetable-gardening crops in the fact that they are more or less permanent occupants of the ground, and therefore must be given an area to themselves, where they will not interfere with the customary plowing and tilling; in the fact that the chief tillage and care are required early and late in the season; and also because the fertilizing is secured chiefly by surface dressings in spring and fall.

(3) Good but inadequate.—This knowledge of the cultural requirements by groups above given affords a practical approach to vegetable gardening. It probably will enable a boy to decide what groups are suitable for his land, and, therefore, what he may hope to grow for his family or cash crop. It may, consequently, be sufficient foundation for the boy's preliminary garden sketch. A careful examination must show, however, that almost everything is yet to be learned as to the individual cultural requirements of the vegetables which the boy selects for his project work.

Accordingly, only so much time should be given to the study of vegetable groups as may be necessary for reasonably intelligent selection of the varieties which are to be grown. In fact, so much knowledge may well be to a large extent a gift from the instructor to the class as a whole.

3. PROJECT STUDY BY VEGETABLE VARIETIES.

Thorough going project study will begin when the individual pupils settle down to the study of the particular vegetables which each has

decided he would prefer to produce. Such study will necessitate the formulation of project-study outlines for the chosen vegetables.

It probably will always be the case that a considerable number of varieties will be selected by the entire class, while other varieties will be selected by but part of the class, perhaps by but a single pupil. Project study would better begin with those varieties with which all are to work. The outline making should, therefore, begin with those varieties which are to be grown by all. Outlines for the remaining varieties may then be made.

Elsewhere [1] a project dealing with a staple vegetable, sometimes grown in the garden and grown sometimes as a field crop, has been carefully analyzed for the purpose of showing the character and extent of the project study pertinent to a single crop.

Two examples of project-study outlines will here be given. These will show project-study materials organized for classroom and individual instruction, in connection with home gardening projects. The first outline determines the precise object of the project; its scope, whether modest or more ambitious; and the things to be done in general preparation of the land, etc. The second deals with a particular vegetable. Moreover, since the vegetable elsewhere analyzed is a staple article of food, namely, the potato, the vegetable here chosen is a salad plant.

Lettuce, the vegetable selected for the second outline, might serve, it will be seen, a most excellent purpose for introducing the study of vegetable growing. Here are some of its advantages for such study: It is an attractive home crop and a very important cash crop. It may be grown in the house, in a hotbed, cold frame, or greenhouse, or in the open; among the earliest vegetables, among the latest and for a continuous summer supply; or to keep the land busy as a companion or succession crop in connection with other vegetables. It teaches the importance of abundant feeding and watering as fundamental to both quantity and quality. It naturally singles out for study one of the most important elements of plant food. Since in connection with it the first labor is likely to be performed, the first seeds, fertilizers and tools used, and the first product disposed of to the family for credit or to the public for cash, it is one of the best vegetables for initiating the keeping of records and accounts.

It will be seen that these outlines overlap slightly at certain points. The wise instructor will make a careful study of such overlapping in his outline making. He will find therein fruitful opportunities for reviewing important elements of both principle and practice. As aids to similar reviewing, references will be found to the approved textbooks used by the pupils in their "agricultural survey" instruction.

[1] Compare 74th annual report, for 1909-10, of Massachusetts Bd. of Ed., pp. 218-222; also, Eleventh Yearbook of the National Society for the Study of Education, pp. 47-90.

If, at first glance, it should be feared that the second outline is too full, it should be understood that no pupil is expected to look up every reference under every question. Further, it should be understood that certain questions of agricultural science which a given instructor intends to treat in connection with the growing of other vegetables may, at that instructor's discretion, be omitted or touched upon but lightly in connection with lettuce. The effort here is to show a good form of outline for use, not only by a whole class in any given school or department but by all classes throughout the entire vocational agricultural education service in Massachusetts.[1]

Matter suggested as desirable, particularly for the study of the most capable pupil, under the heading "Broader results, project-study record diagram," figure 3, Chapter II, has been dealt with in the following outlines in footnotes. Such questions as those in the footnotes may be omitted by all save the most exceptional pupils.

The first outline immediately follows; the second begins on page 62.

(1) Suggestive project-study outline—Kitchen gardening.

Project: Kitchen gardening.

Object, Scale, and First Steps of Projects.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
1. Shall you grow vegetables?[2]	(1) What are the advantages of a good home garden? 1: 187-188 5: 325 13: 5-6 16: 3-6, 8, 11 25: 335 27: 10, 12-16 39: 3, 490 40: iff. (2) Could you sell part or all of your product outside the family?
2. Where shall you grow them?	(1) Where was the home garden last year? A. Did the vegetables grow well in it? B. Was it large enough to supply the family or were such vegetables as winter squashes and potatoes grown as field crops? (2) May it be desirable to change the location of a garden or of the place of growing certain vegetables in an old garden? A. What is "rotation" and its significance for vegetable growing? 26: 13 39: 493 276: 32-34 (3) Which way should the garden slope? 26: 7 (4) What soil is best for a garden?[3] 1: 188-189 26: 7-8 27: 22 39: 19, 21f., 25-26, 27

[1] The Massachusetts Board of Education now has in the hands of the printer a bulletin of about 115 pages, giving outlines prepared by the vocational agricultural instructors for their pupils in 1912-13, in which the following vegetables are treated:

Beans.	Celery.	Parsnips.	Rhubarb.
Beets.	Cucumbers.	Peas.	Spinach.
Cabbages.	Melons.	Potatoes.	Sweet corn.
Carrots.	Onions.	Radishes.	Tomatoes.

Other bulletins are in preparation, containing project-study outlines on fruit growing, poultry keeping, swine husbandry, and bee keeping, all of which have grown out of the last year's teaching.

[2] What is "olericulture?" 39: 1. 276: 1-6.

[3] What do you know about "portable soil" and renting contracts among small gardeners near Paris?" 87: 14.

Kitchen gardening—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
2. Where shall you grow them—*Continued.*	(5) May the garden vegetables be part of a field crop? How? Advantage? 1: 188 (6) Is protection from the wind important? Why? 39: 14 (7) Is good drainage a necessity? Why? 1: 189 5: 91-92 13: 9 39: 26 (8) On the whole, what may be considered the best location for a garden? 1: 188 5: 235 11: 451 13: 6 27: 20 39: 12-14, 491, 492-493 (9) Shall you grow vegetables under glass?[1] A. What are "hotbeds" and "cold frames"? Cost of construction and operation? 5: 236-237 11: 483 13: 12-15 25: 145 39: 355-356 276: 44-79 747: 250-253 876: 94-96 B. Shall you use a "cold frame"? C. Shall you use a "hotbed"? (10) In view of the above, where shall you grow your vegetables?
3. What kinds shall you grow?	(1) Shall you grow both hardy and tender vegetables? A. What are "hardy" and "tender"? 753: 159 (2) What is a practical way of grouping vegetables by their cultivation requirements? 39: 196-200, 241 276: 240-242, 271, 301, 314, 329, 347, 356, 380, 392, 411, 423, 429 433 (3) What kinds are liked best by your family? (4) What kind could you sell best? (5) What kinds or varieties, therefore, shall you grow for A. Family use? a. Summer? b. Winter? B. Sale?
4. What quantities shall you grow?	(1) Shall you undertake to supply your family with all of the vegetables needed for the entire year?[2] A. What kinds of vegetables were used on the home table last year? B. What quantity of each was required? C. What were grown at home and what were purchased? D. About what was the total value of the vegetables used in the last 12 months by your family? E. Shall you work alone or in cooperation with some of your family, a neighbor, or a fellow pupil? 16: 9-10

[1] Open air v. hothouse returns, according to Twelfth Census? 853: 194.
[2] What may cooperatively small areas produce under the best methods? 5: 234 13: 5 33: 9-17 276: 31, 35 853: 60-107, 118-121, 126, 127, 407-408.

Kitchen gardening—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
4. What quantities shall you grow—*Contd.*	(1) Shall you undertake to supply your family with all of the vegetables needed for the entire year—*Continued.* F. How large was the garden last year? Sketch outline, give dimensions, and figure area. G. How large a garden will supply a family of five or six? 11: 454–455 276: 31, 35–43 H. In view of the foregoing study, and assuming that a garden should be cultivated carefully about twice a week for the family supply, how large an area shall you undertake to work? (2) Shall you grow a surplus for sale? A. What quantity could be readily sold? B. What would be the cost of marketing? C. In view of the above, what quantity shall you try to produce for sale and what land allowance shall you make?
5. Shall you map your garden?	(1) Advantages of, and materials for making a garden plan? 25: 8, 24–28, 42 27: 21, 23, 25 271: 279–284 753: 324 876: 61 A. What scale shall you use? a. What is "drawing to scale"? B. Shall you show the points of compass? Why? 876: 61 C. Which way shall the rows run—lengthwise or crosswise? 276: 31–32 D. Shall the rows run north and south? Why? 25: 8–11 E. Shall your plans show such double cropping as you have decided upon? a. What is "double cropping"? 39: 475–489 F. In what part of the garden shall you put low-growing and in what part high-growing plants? G. Shall you observe strictly the rules of "rotation" in locating your deep and shallow rooted plants? H. What are some model kitchen garden plans? 11: 8–9, 451–454 13: 7–8 16: 2–24 25: 11–14 27: 21, 23, 25 31: 20–21 276: 33, 37, 39, 41
6. How and when shall you prepare your land?[1]	(1) Shall you use stable manure? A. Value of stable manure in vegetable growing? Should it be well rotted? Apply when and how much? B. How should stable manure be stored and handled? C. Should it be thoroughly mixed with the soil? Plowed or spaded under? Or raked, spaded, or harrowed in? 1: 97–100, 188 13: 11 16: 30–31, 33–35 24: XVII 25: 4, 5, 7, 112 27: 35–38 39: 41–42, 49–50, 492 271: 275 285: 173–181 616: 5–32, esp. 16–29 697: 113–181 876: 50–57

[1] What are motives for fair and square treatment of the land? 1: 100 876: 57–58.

Kitchen gardening—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
6. How and when shall you prepare your land—*Continued.*	(1) Shall you use stable manure—*Continued.*
	D. What will your manure cost?
	(2) Shall you use green manure?
	A. What is "green manuring"? What are its advantages and disadvantages?
	1: 100 **25:** 16–17 **39:** 53–57
	279: 349–370, esp. 349, 370
	285: 171, 183, 185, 186, 188, 189, 191 **876:** 58–59
	(3) Shall you use compost?
	A. What is "humus"? What does it do?
	5: 95–96 **25:** 4, 7, 8, 61, 246, 247, 274, 299, 306
	27: 22 **278:** 25–26, 31, 35, 67
	285: 27, 38, 41, 43, 44, 62, 67 **752:** 108–109
	767: 33, 38, 48, 51
	B. What is "compost"? How made?
	25: 17, 18, 34, 61, 112, 113, 152, 306 **26:** 21
	278: 242, 243 **285:** 171, 181 **876:** 59–60
	C. What is "short" manure? Should stable manure be composted?
	24: XVIII **27:** 36–38 **39:** 47–49
	276: 95–96
	D. What will your compost cost?
	(4) Shall you use commercial fertilizer?
	A. Most lands usually contain sufficient quantities of all save what elements of plant food?
	11: 111
	B. What is "commercial fertilizer"? Its uses and its sources?
	1: 97–98 **5:** 114–125, 131, 132, 408 **13:** 11–12
	24: XX **25:** 6, 32–35, 58–71 **39:** 58–65
	C. What may be considered an "all-around" fertilizer, or a "basic mixture," for vegetable growing?
	25: 33 **276:** 104–106 **633:** 267
	a. Shall you use a basic or all-around mixture?
	b. If so, what will it cost?
	D. Shall you use commercial fertilizers separately, and not mixed?
	a. Do certain vegetables prefer particular fertilizers, as, for example, celery, beets, peas, lettuce, cabbages and tomatoes?
	5: 116–123 **25:** 146 **26:** 225
	39: 235, 250, 270, 312, 356, 411–412, 458–460 **276:** 359
	409: 64 **633:** 277
	b. What shall you spend for commercial fertilizers?
7. Shall you use lime?	(1) Shall you use lime on your vegetable land?
	A. What is the effect of lime upon the soil?
	279: 304–307 **6**

Kitchen gardening—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
7. Shall you use lime—*Continued.*	(1) Shall you use lime on your vegetable land—*Continued.*
	B. Effect upon the plant?
	279: 302-304
	C. When most beneficial?
	279: 307-309
	D. How can you tell when lime is needed?
	5: 126 **25:** 7 **39:** 65-66 **279:** 309-310
	752: 98 **767:** 95-99 **770:** 46-50
	E. When, in what forms, and how may lime be applied?
	5: 127-128 **278:** 70 **279:** 302-311, 314
	F. Where shall you get your lime, and what will it cost?
8. How deeply and thoroughly shall you pulverize your vegetable soil?	(1) It may be assumed that, in deciding the above questions as to plant foods and their application, the dates and manner of plowing and harrowing have been in part determined. Other questions, however, remain to be answered.
	(2) What is the relation of a thoroughly pulverized seed bed to quick germination and rapid growth? Best tools to use? Best methods of using them?
	1: 74-76, 83-87, 96, 190 **11:** 87-114
	13: 9-10, 15, 21-22 **24:** XIX **25:** 35-42
	39: 28-40 **276:** 155 **278:** 91-130
	279: 390-392 **285:** 90-92, 150-158 **767:** 67-72
	770: 5-6 **876:** 77-78, 88-89
	A. What tools shall you use?[1]
	a. What have you now? Make a list.
	b. What must you buy? Make a list.
	B. What will be your expense for these tools?
9. Plant how?	(1) What are the relative advantages of planting by hand, and with a planter or seed sower?
	11: 117 **16:** 94 **24:** xiii, xiv, xix-xx
	25: 54 **39:** 135, 137 **276:** 163-164
	A. Shall you use a planter or seed sower?
	B. What will it cost you?
10. Cultivate how?	(1) What is the relation of "clean culture" and preservation of a thin "earth mulch" to quality and quantity of vegetables? And shall you use horse or hand tools?
	11: 95-96, 101-107 **13:** 21 **16:** 96-103
	25: 31-32, 35-37, 38 **27:** 18, 52-56, 157-159
	39: 358 **276:** 360 **853:** 112-113 **874:** 76-81
	A. Are weeds ever beneficial? What are weeds? Are there not better "cover crops"?
	409: 88 **768:** 71-73
	B. Should care be exercised in weeding and cultivating?
	25: 37-38
	(2) What tools shall you use for cultivating?
	(3) What will these tools cost?
	Compare **25:** 32, 36, 37

[1] What do you know about the history and kinds of tillage tools? **5:** 82-94 **25:** 31-32 **271:** 81

Kitchen gardening—Continued.

Guiding questions for planning this project.	Guiding questions for studing and understanding this project.
11. How gather, care for, and dispose of product?	(1) The questions as to tools, receptacles, etc., required for gathering and disposing of the garden vegetables can be better answered after the individual varieties to be grown have been studied. (2) What means of storage have you, or shall you provide? [1] **11:** 158–161, 475 **25:** 113–119 **39:** 193–195 **274:** 141, 142, 146, 147, 149 **276:** 214, 224–235 **753:** 162–163 **767:** 31–33, 48–79, 80, 81, 86, 87, 109 (3) What salesmanship principles as to attractiveness of person and products, advertising, etc., shall you put into practice in selling your surplus? **5:** 380–383 **39:** 162–192 **276:** 214–224 **753:** 327–328 **761:** 154–160 **850:** 33, 35, 41, 42, 69, 72, 74, 77, 79, 87, 88, 92
12. What accounts shall you keep of your gardening project?	(1) What are proper elements of cost and the best methods of accounting in vegetable production? **5:** 380–383 **39:** 162–163 **276:** 214–224 **465:** 109–138, 139–144, 145–197 **492:** 1–21, 22–41, 82–100 **753:** 327–328 **761:** 154–160 **782:** 157, 159 (2) What account with your family shall you keep? **492:** 143–152

[1] What do you know about the canning and preserving of vegetables? **271:** 157–177.

(2) *Suggestive project study outline—Lettuce growing.*

Project: Kitchen gardening.

Subproject: Lettuce growing.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
1. Plant where?	(1) Where have you seen good lettuce growing? Of whom may you seek advice? [1] **31:** 15 A. Lettuce belongs to what cultural class, and what are the soil requirements of that class? **276:** 241 B. What soil is best for lettuce? **39:** 355 **276:** 356, 358–359 **874:** 119 C. At what spot are your soil conditions best for lettuce? How best? **874:** 54–55 (2) Shall you grow lettuce in more than one part of the garden? [2] A. What is companion cropping? **39:** 357–358, 477, 478, 480, 482, 488 **276:** 358 **747:** 257 B. What is succession cropping? **1:** 189 **25:** 13 **31:** 22–23 **271:** 105 **276:** 358–359 **853:** 191–192, 330 **876:** 119

[1] Origin and importance of lettuce? **11:** 483 **25:** 149 **38:** 361 **39:** 351 **276:** 360. Botanical features and classifications? **26:** 223 **276:** 360–361 **285:** 85–96.

[2] Possible returns from double cropping? **553:** 329–331.

Lettuce growing—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
1. Plant where—*Contd.*	(2) Shall you grow lettuce in more than one part of the garden—*Continued.* C. In view of the above references, what combinations might you make? D. What combinations shall you make? (3) Where shall you start your plants? A. In the house? 1: 190 25: 63-68, 145 26: 47 285: 51 767: 212 876: 92-93, 119 B. Under glass? [1] a. What is a cold-frame? A hotbed? 5: 236-237 11: 483 25: 145 39: 355-356 276: 44-79 747: 250-253 876: 94-96 C. How much time may be gained by starting plants indoors or under glass? 25: 51-52 31: 113 39: 355 276: 49 (4) How large an area needed? [2] A. In the garden? a. Plants per acre? 851: 329 b. How may thinnings be used? Relations of such use to area required? 11: 483 24: 152 25: 146 31: 33 276: 359 876: 91 c. Your estimate of area needed? B. Under glass? a. What is a "sash"? 276: 46 b. What is a "frame"? 276 46 c. Number of lettuce plants per sash? 31: 113-114 276 46 d. Your estimate of space needed under glass?
2. Plant what?	(1) What varieties have you seen or eaten? [3] (2) What variety is best liked by the family? (3) What variety sells best where you might sell your surplus? (4) Is there a better all-round variety than Black Seeded Tennis Ball? Why? 11: 484 25: 50, 130, 131, 144-145, 147 26: 225-226 31: 24, 33, 113 39: 351-354 276: 358 292: 557-558 876: 119 (5) What is your estimate of the quantity of seed needed? 11: 4[illegible] 26: 46 39: 495

[1] What do you know of experimental lettuce growing and its production under glass by market gardeners? 271: 23-26, 30, 33, 120, 122 747: 248-250 876: 93.
[2] Heads per acre and possible profit? 31: 114 39: 358.
[3] What are some estimates of the number of known varieties of lettuce? 276: 361.

Lettuce growing—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
3. Plant when?	(1) What is a "planting table"? **25:** 327-334, esp. 331 **274:** 106 (2) How long does it take lettuce to mature for table use? **25:** 149 **31:** 33, 113 (3) How early and how late may lettuce be planted? **25:** 144, 146, 149 **26:** 223-225 **31:** 21-22 **33:** 113-114 **39:** 357-358 (4) Should supply be sought for hot months? **1:** 191 **11:** 484 **25:** 147-148 **39:** 354 **276:** 357-359 (5) What is "pricking out" and how is it done? **24:** xxii-xxiii **25:** 145-146 **876:** 94 (6) Does transplanting aid heading? **31:** 114
4. Seed, get when and where?	(1) Shall you use home-grown or purchased seed?[1] (2) Shall you grow your own seed for next year? **26:** 51 **276:** 165-168 **292:** 179 A. Pound of seed from how many plants? **39:** 355 B. What is the appearance of lettuce seed as to size, shape, surface, and color or colors? **25:** 149 **38:** 361 (3) Shall you get your seed early and test it? **25:** 52-53 A. What is the relation of a high-sprouting test to high vegetative power? **276:** 149-154, esp. 151. B. What conditions are required for sprouting seeds? **285:** 70-75 C. Is lettuce seed naturally strong or weak? a. How shall you make a test for percentage of germination? **1:** 230-231 **5:** 49, 51 **31:** 25-27 **271:** 280 **75:** 20 **876:** 87-88 b. Make the test for strength, using lettuce seed instead of corn, and otherwise following directions given in reference. **285:** 81-82 D. How shall you test your lettuce seed for percentage of impurities? **5:** 51-52 **876:** 88 E. What is "longevity" of seeds, and how does lettuce seed compare with other seeds in longevity? **5:** 405 **276:** 138

[1] What is a seed? **279:** 381. Why is lettuce called an "annual"? **31:** 33 **38:** 361. Most of seed is produced where? **39:** 358. Is changing seed ever an advantage? **279:** 384-386.

Lettuce growing—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
4 Seed, get when and where—*Continued.*	(3) Shall you get your seed early and test it—*Continued.* F. Do new and old seeds look alike? **25:** 46 **279:** 388 G. Is large seed better than small? **5:** 53–54 **270:** 388 **876:** 226–227. H. How may large be separated from small? **25:** 46 I. What is the cheapest seed?[1] **5:** 52–53 (4) Where can you get the highest grade lettuce seed? (5) When can it be had? (6) At what cost?
Fertilize, with what, when, and how?	(1) Has your garden been heavily fertilized with stable manure? A. What is heavy manuring for a garden? **31:** 17–19 B. How many cords of manure per acre may be used for lettuce? **25:** 145–146 **31:** 113 C. Has your manuring been sufficient for your lettuce? (2) Shall you use a mixture of commercial fertilizers for your garden? A. What is a "basic mixture" for vegetable growing? **276:** 104–106 **633:** 267 B. How apply? **39:** 59–65 **285:** 15 (3) What special kind of commercial fertilizer gives the quickest and best growth of lettuce? What are the sources of it and symbol for it? **5:** 116–123 **25:** 146 **26:** 225 **39:** 356 **276:** 359 **633:** 277 A. What is the relation of the quality of lettuce to rapid and continuous growth? **276:** 106 **292:** 178 B. How, when, and at what rate may nitrate of soda be safely applied? **25:** 146–147 **26:** 27–28 **31:** 7 **39:** 60–61 **292:** 178 **409:** 57 C. How do plants feed?[2] **1:** 96, 105, 107 **5:** 64–67 **285:** 17–20 **750:** 16–17 **768:** 52–66 D. Why is a fertilizer which is readily soluble "quick acting"?

[1] What are other seed tests which may be made? **767:** 202–211.

[2] What tests or experiments have you made for noting the presence of nitrogen and its action? What can you say of its sources and its relations to plants? **1:** 79–80, 98, 100 **5:** 60, 61, 63, 97, 113, 116, 119, 121, 122, 136, 138, 139, 140, 141 **398:** 220–248 **409:** 10, 11, 20, 37, 43, 49, 87, 92, 97, 99, 105, 108, 110, 170, 171, 206, 214, 216, 217 **410:** 26–30, 179–184, 339 **747:** 24, 34, 35, 37, 39–40 **761:** 28 **768:** 21–23.

[3] What can you say about the nature and growth of roots? **298:** 39, 41, 45, 49, 54, 60, 61, 62, 77, 82, 160, 161, 167, 247, 447 **768:** 62–66.

Lettuce growing—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
5. Fertilize, with what, when, and how—*Con.*	(4) If your lettuce area is small, may liquid manure be used to advantage? A. How prepare it? How control its "strength?" Is it a plant food or a "plant tonic?" **24:** xix **25:** 101–102, 104 **39:** 61 **876:** 104
	(5) When shall you get your plant food supplies?
	(6) What will be the cost of your lettuce fertilizer? Compare **25:** 33
6. Shall you use lime?	(1) Is your land quick? A. When is land "quick?" **276:** 85 B. How may lime aid quickness? **276:** 96 **285:** 149, 200 **876:** 230
	(2) Should lime be used in vegetable growing? How find out? **5:** 126 **25:**7 **39:** 65–68 **279:** 310 **752:** 98 **767:** 95–99 **770:** 46–50
	(3) Is lettuce sensitive to soil acidity? **5:** 126
	(4) When and in what forms may lime be applied? **5:** 127–128 **278:** 70 **279:** 309–311, 314
	(5) What will your lime cost?
7. Prepare ground for seed with what and how thoroughly?	(1) What is the relation of a thoroughly pulverized seed bed to germination and growth? Best tools to use? Cost? Best method of using them? **1:** 74–76, 83–87, 96, 190 **11:** 87–113 **13:** 9–10, 15, 21–22 **24:** xix **25:** 35–42 **39:** 28–40 **276:** 155 **278:** 91–122 **279:** 390–392 **285:** 90–92, 156–158 **767:** 67–72 **770:** 3–6 **876:** 77–78, 88–89
	(2) Keep accurate record of cost of preparing ground, including proper proportion of original plowing and harrowing.
8. Plant how?	(1) Shall you plant by hand or with a seed sower? **11:** 117 **16:** 97 **24:** xix–xx **39:** 137 **276:** 163–164 A. How is a seed sower set for lettuce seed? B. How is lettuce seed planted by hand? **25:** 54–55 **39:** 135
	(2) Shall you soak your seed? **39:** 134
	(3) Shall your rows be straight? **25:** 36

[1] What do you know about the history and kinds of tillage tools?—**5:** 82–94 **252:** 31–32 **271:** 81.

Lettuce growing—Continued

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
8. Plant how—*Continued.*	(1) Plant how deep, and how far apart between rows and between plants? To what extent should size of seed, time of year, weather, and soil conditions control depth and distances? **1:** 190 **11:** 117–118 **13:** 47 **25:** 53–54, 327, 331 **31:** 113 **39:** 133–134, 357 **285:** 81 **747:** 254 **753:** 159 **874:** 89–93
	(5) Keep itemized record of cost of planting.
9. Cultivate how?	(1) Shall you cultivate your lettuce with both horse and hand tools? **11:** 95–96, 101–107 **16:** 90–103 **25:** 35–37 **27:** 18, 52–56, 157–159 **39:** 358 **276:** 360 **853:** 112–113 **876:** 76–81
	(2) Keep items of cost of cultivation.
10. Shall you water?[1]	(1) What is "free" water? How far from the surface is the "free-water" level in your lettuce ground? **285:** 48–49 **289:** 45–46 **683:** 29
	(2) What is "capillary" water? Perform at least one experiment for observing the movement of "capillary water." **25:** 55–56 **285:** 44, Fig. 24; 48, Fig. 26, Fig. 27; 49–50, Fig. 28 **289:** 41 **681:** 40 **747:** 14 **762:** 80–85
	(3) What is "film" water. How much film surface should a cubic foot of clay loam particles have? **5:** 80 **285:** 50–52 **289:** 22–24 **581:** 4–5 **683:** 30 **747:** 10–12 **762:** 75–80
	(4) Where does all water come from? **5:** 61
	(5) What use does a plant make of water, and how does it take it from the soil? Perform an experiment for observing the process of "osmosis."[2] **5:** 64–67, 73 **285:** 39 **289:** 42–43 **2198:** 64 **752:** 17–21 **768:** 16–19, 24 **772:** 201–204
	(6) What is the comparative water-absorbing power of different soils, including a good quality of garden soil? **285:** 45, Fig. 25
	(7) What quantities of water do different plants require for maturing their crops? **5:** 62–63, 67 **285:** 40
	(8) Does lettuce require much or little water for the quickest and best growth? **34:** 83 **39:** 358
	(9) What is meant by "watering with the hoe"? **5:** 85–86 **25:** 55–56 **876:** 102–103
	(10) Under what conditions, if at all, is it advisable to water after sowing lettuce seed? **25:** 56

[1] What part has water played in soil formation? **289:** 7–15 **681:** 10–14 **683:** 3, 11, 15 **685:** 74–108.

[2] What are "plasmolysis" and "wilting" of lettuce? **278:** 69, 80, 81.

Lettuce growing—Continued.

Guiding questions for planning this project.	Guiding questions for studying and understanding this project.
10. Shall you water—*Con.*	(11) Why "never sprinkle"? When, how, and in what quantities should water be applied? **1:** 190–191 **11:** 100 **13:** 22-23 **25:** 41, 104–107 **31:** 114 **876:** 104 (12) Keep account of cost in time and equipment for watering.
11. Protect from what plant enemies, and how?	(1) What enemies attack the lettuce plant? A. Indoors or under glass? B. In the open? **24:** 123 **25:** 71–72,149 **26:** 226 **30:** 3 16 **39:** 356, 358 **274:** 273, 322 **276:** 364 **292:** 179–180 **768:** 102 **876:** 119 (2) Which need you fear? (3) What protection against flea-beetle? **25:** 71–72 (4) Mice? **39:** 356 (5) Cut-worms? **25:** 73, 76 **276:** 38 **558:** 47 (6) Keep account of expense for protection in time and materials.
12. How harvest, dispose of product, and balance the lettuce account?	(1) For family use? Credit received at market price? **11:** 483 **13:** 35 **24:** 153 **26:** 224–225 **39:** 357 (2) For sale? Blanched? **11:** 484 **39:** 352, 358 (3) What principles of salesmanship and accounting shall you put into practice? **5:** 380–383 **39:** 162, 163 **276:** 214–224 **465:** 109–138, 139, 144, 145–197 **492:** 1-21, 22–41, 83-100, 148-152 **753:** 327–328 **761:** 154-160 **782:** 157, 159 **850:** 33, 35, 41, 42, 60, 72, 74, 77, 79, 87, 88, 92 (4) Shall you keep a separate lettuce account, or include outlay and receipts in the account of the kitchen-gardening project as a whole?

How serve lettuce? Its place in an attractive and wholesome diet? **25:** 147–149, 182 **874:** 119-120.

Chapter IV.

AGRICULTURAL PROJECT STUDY BIBLIOGRAPHY.[1]

APPROVED FOR MASSACHUSETTS VOCATIONAL AGRICULTURAL SCHOOLS AND DEPARTMENTS.

The Massachusetts plan of vocational agricultural education of secondary grade depends for its best success upon the constant use, under the guidance of the instructors, of current agricultural papers and periodicals. It depends, also, upon the constant use of selected text, exercise, and reference books, bulletins, circulars, and reports.

In selecting the titles which appear in this chapter the advice of practical farmers and of experienced agricultural instructors has been sought and has been very generously given. Final responsibility, however, for the titles included rests with the writer. Text and reference materials have been carefully examined. Not a little material has been rejected as unsuitable for the purpose in hand. The lists are intended to be illustrative, not all-inclusive.

1. AGRICULTURAL PAPERS AND PERIODICALS.

Each Massachusetts vocational agricultural library should regularly receive the current agricultural literature. The pupils should, moreover, be encouraged to subscribe for those publications which promise to be most useful in their individual home work. Club rates may generally be secured where several persons subscribe together.

In order to place their literature regularly before the entire school or department, the publishers may be willing to send the literature gratis to the school or department libraries. This privilege should immediately be requested.

If library copies can not be secured gratis, they should be had by subscriptions paid annually from the maintenance funds of the school or department.

2. FREE BULLETINS, CIRCULARS, AND REPORTS.

(1) **The United States Bureau of Education** is closely following the development of vocational agricultural education of secondary grade. It has published much useful material, including Bulletin No. 481, a "Bibliography of Education in Agriculture and Home Economics." The agricultural instructors should apply on behalf of their school or department libraries for such of the free publica-

[1] This chapter reproduces with some additions materials first published as Bulletin, No. 6, 1912, by the Massachusetts Board of Education.

tions of the bureau as bear upon vocational agricultural training in secondary schools.

Applications should be addressed to the United States Commissioner of Education, Washington, D. C.

(2) **The United States Department of Agriculture** issues many agricultural bulletins, circulars, and reports. Certain of these have directly to do with Massachusetts farming problems. Others deal with problems in other States, where the agricultural conditions closely approximate those in this State.

Access to this literature nearly up to date may be had by applying to the Division of Publications of the United States Department of Agriculture, Washington, D. C., for Circular 19, entitled "Publications of the Department of Agriculture classified for the Use of Teachers." This was issued under date of January 27, 1912. Access to later literature may be had by requesting that the "Monthly List of Publications" be sent the library of the school or department. Each agricultural instructor should apply for, and use, both Circular 19 and the regular issues of the "Monthly List."

Literature mentioned by Circular 19 and the "Monthly List" may usually be had free by applying for it to the Secretary of Agriculture, or to the Senator or Representative of the district in which the applicant works or resides.

(3) **The Agricultural Experiment Stations** also issue literature of value to progressive farmers, and therefore of value in the project method of training. In Connecticut and in New York there are two such stations; in every State there is at least one.

All of the New England and New York stations have kindly consented to put our vocational agricultural school and department libraries on their mailing lists. The literature they send should be carefully filed. Occasionally literature from the stations in other States may directly bear upon the productive projects undertaken by our boys. A sharp lookout should be kept for such literature.[1]

Such a lookout may be kept by means of the "Card Index of Experiment Station Literature," which is published by the United States Department of Agriculture. More than 30,000 cards have already been printed.[2] Each agricultural school and department

[1] Each State should, of course, develop lists of reference materials specially suited to its own needs and available sources of information.

[2] In order to show the exact nature of the clews to station literature, pertinent in one respect or another to Massachusetts farming projects, which this card index affords, the subject matter on four cards is here printed.

Index Card 61806.

"Poultry appliances, labor-saving."—J. E. Rice and C. A. Rogers.

"New York Cornell Bul. No. 284, Nov., 1910, pp. 51 .....

"Directions are given for the construction of inexpensive, unpatented labor-saving devices for poultry raising. They include feeding and watering devices, pedigree and egg-collecting appliances, catching and carrying devices, shipping packages, coops for sitting hens, fattening coops, a rack for sprouted oats, a burglar-alarm system, and an improved killing and picking box."

[Footnote continued on next page.]

library should endeavor to secure a partial set of these index cards. Since many of the bulletins referred to on the earlier cards are now out of print, it probably will be best to start the subscription at card 31500. The number of the sets at present is limited, but now and then a former subscriber relinquishes his rights, and a subscription may be allowed a school or department.

Subscriptions for divisions of this index, such as all cards dealing with "Poultry," "Fruit," and the like, cost $3 per thousand cards; with $1.25 additional, at the outset, for colored division cards to be used in arranging and readily consulting the index. Divisions may be subscribed for until full sets become available. The Office of Experiment Stations of the United States Department of Agriculture will receive the subscriptions for both sets and divisions.

A key to the index, containing the system of classification, is sent on application.

Make payments in advance by United States postal order in favor of A. Zappone, disbursing officer, and forward in envelopes addressed to the Director of the Office of Experiment Stations, Washington, D. C.

Footnote—Continued.

Index Card 31810.

"**Milk pails, covered, tests.**"—H. A. Harding, J. K. Wilson, and G. A. Smith.

"*New York State Bul. No. 328, Dec., 1910, pp. 549–581, pls. 4*"

"A report of experiments to determine the effect on the germ content of using improved milk pails. More than one-half the infection that milk receives during the milking process can be prevented by use of a covered pail. Such a pail, less than 12 inches high and provided with an elliptical opening 7 by 5 inches, is practically as convenient for milk as the open pail. Such a cover can be placed on an open pail by any tinsmith at very little expense. This pail is inexpensive, durable, easily cleaned, and one of the most efficient in keeping bacteria out of milk."

Index Card 31831.

"**Vegetable garden.**"—W. H. Wicks.

"*Idaho Bul. No. 69, Aug., 1910, pp. 49, figs. 10, dgms. 2*"

"The record for two years is given of a one-half acre vegetable garden established in the spring of 1908 on the horticultural grounds of the Idaho station. The value of the products in 1908 was $82.19, with net profits of $57.41; in 1909, $98.38, with net profits of $79.22. The conclusion is reached that by judicious arrangement of the gardens continuous supply of vegetables may be secured throughout the season. A plan is given of a farmer's vegetable garden, together with cultural suggestions on farm garden crops and recommended varieties."

Index Card 31943.

"**Feeding experiments with pigs.**"—A. L. Stabler.

"*Maryland Bul. No. 150, Jan., 1911, pp. 89–120, fig. 1*"

"Pigs fed silage made faster gains than those fed ground fodder mixed with their feed. Young pigs made faster gains on corn meal and skim milk than on shelled corn and skim milk. Pigs fed mixed grain soaked 24 hours made faster and more economical gains than those fed the same mixture dry or fresh soaked. Chopped alfalfa failed to take the place of a part of the middlings in a ration consisting of shelled corn, wheat middlings, and skim milk. Soft coal in unlimited quantities seemed unharmful for pigs in pens. The use of a tonic mixture, wood charcoal and soft coal, as correctives increased gains. Other feeding tests are reported."

(4) Massachusetts Agricultural Experiment Station literature, of course, is covered by the card index above described. In order that there may be no delay, however, in securing such of its publications as may be needed at once, the following list of those now available is given:

Bulletins and their numbers—
33. Glossary of fodder terms.
76. The imported elm-leaf beetle.
115. Cranberry insects.
123. Fungicides, insecticides, and spraying directions.
125. Shade trees.
133. Green crops for summer soiling.
134. The hay crop.
137. The rational use of lime. Also, the Distribution, composition and cost of lime.
138. Tomato diseases.
139. Inspection of commercial feedstuffs (October, 1911).
140. Inspection of commercial fertilizers (December, 1911).

Technical bulletins—
2. The graft union.
3. The blossom end rot of tomatoes.

Circulars—
20. The use of lime in Massachusetts agriculture.
22. Poultry manures, their treatment and use.
26. Fertilizers for potatoes.
27. Seeding mowings.
29. Chemical analysis of soils.

Applications for these and future publications of like character should be addressed to the Director of the Massachusetts Agricultural Experiment Station, Amherst, Mass.

(5) "Facts for farmers," issued monthly by the Extension Service of Massachusetts Agricultural College, is a live leaflet on timely topics which bear directly upon Massachusetts farming from season to season. A full file of these leaflets should be preserved for reference in each agricultural school and department library. Members of the agricultural classes, or their fathers, may receive copies for their individual files by asking that their names be put on the Extension Service mailing list.

Applications should be addressed to W. D. Hurd, Director of the Extension Service, Amherst, Mass.

(6) The Massachusetts Board of Agriculture publishes agricultural bulletins and reports, a complete file of which, beginning, say, January, 1910, should be at hand for reference. In addition to the annual volumes, the board of agriculture has printed such special bulletins as the following: 1. Poultry Culture. 2. Orcharding. 3. Grasses and Forage Crops. 4. Small Fruits and Berries. 5. Vegetable Growing.

Applications for its publications should be addressed to the State Board of Agriculture, State House, Boston, Mass. Copies may be

had not only by the libraries, but also by individual agricultural students.

(7) **The State forester's** work closely concerns all farmers who are confronting the problems of protection against brown-tail and gypsy moth depredations, of protection against forest fires, and of economically cropping their wood or timber lots, and of disposing of lumber to their best advantage. Each agricultural school and department should keep a complete file of the State forester's publications. Most of these publications are fully illustrated and may be had by both the libraries and the individual agricultural students.

Following are some of the publications now available:

1. Forest trees of Massachusetts: How you may know them. A pocket manual.
3. Massachusetts wood-using industries.
4. The evergreens. Methods of study in public schools.
5. Reforestation in Massachusetts.
6. How and when to collect white pine seed.
7. Forest mensuration of the white pine. How to estimate standing timber.
8. How to make improvement thinnings.
10. Forest fire-fighting equipment in our towns.
11. Gypsy and brown-tail moths.
14. Colored plates of the gypsy and brown-tail moths and calosoma beetle.
—. The chestnut bark disease.

Applications for these and future publications should be addressed to the State Forester, 6 Beacon Street, Boston, Mass.

3. TEXT, EXERCISE, AND REFERENCE BOOKS, BULLETINS, CIRCULARS, AND REPORTS.

Copies of the books, bulletins, circulars, and reports hereafter listed are on file in the agricultural library of the Massachusetts Board of Education, where they may be examined by school officers. Where vocational agricultural school and department work is started certain copies should be provided at the outset. These are necessary parts of an approved equipment for the present year. Others may be added in succeeding years, until an adequate working library has been established.[1]

(1) **Instructor's aid necessary.**—It is, of course, understood that the following lists are for the convenience of the several instructors, and for use by classes, with the help, step by step, of these instructors. Reference materials, therefore, suited to minds of different grades of maturity have been included. Some have been successfuly used in elementary schools; others, by secondary schools, and even by college classes. The instructor's intimate knowledge of the needs and mental capabilities of his individual boys will determine his assignment of both laboratory exercises and reading matter.

[1] Prof. G. F. Warren, "Elements of Agriculture," pp. 402, 403 (see below, No. 2), lists a foundation set of secondary school agricultural reference books purchasable for about $50.

(2) **Lists subject to revision.**—It is to be expected that from time to time additions to these lists will need to be made. Suggestions as to usable additions are earnestly solicited. The instructors are especially requested to report which of the entries here included prove best suited to their different classes. The most competent revision of these lists will thus be assured.

(3) **Prices and estimates.**—Postage or express charges must be added where prices are marked "net." For example, "The Country-life Movement," by Prof. L. H. Bailey, is listed as follows: "$1.25 net; by mail, $1.34." Discounts from prices not marked "net" may usually be expected.

(4) **Student purchases.**—Prof. L. H. Bailey, in addressing winter short-course students at the Cornell Agricultural College, is reported to have said that he hoped, if they took nothing else home, they would take home with them ten or twelve dollars' worth of good books dealing with the branches of practical agricultural production which they expected to follow. A similar hope might well be expressed on behalf of the boys who seek vocational agricultural school training such as that described in this bulletin.

Fortunately a few most excellent books for home guidance in profitable farm work are now to be had at moderate cost. The agricultural instructors may properly enough seek to stimulate the boys in their classes to purchase one or more such books every year. Wise guidance may be given by observing which books actually prove to be most useful to the individual boys in carrying out their particular home farm projects.

Publishers will undoubtedly be very willing to allow the boys their most favorable school discounts, especially if orders are forwarded through the school purchasing agent.

(5) **Reference numbers.**—The Arabic numbers at the left of the entries are for convenience in referring to materials found in this bibliography.[1]

A. Library arrangement.—If these numbers are put on the backs of the books, on the fronts of the pamphlet cases in which bulletins are filed and on the shelves where sets of reports are kept, it will not be necessary to consult these printed lists in using the agricultural library. The student or instructor may go directly to the materials themselves, on the library shelves. In cases where schools already have libraries and systems of numbering, these special numbers may be added.

B. Project outlines.—In the outlines for project instruction found in Chapter III the following entries are referred to by number, not

[1] A similar use of numbers for ready reference has been made in "Laboratory Exercises in Farm Management," by Warren and Livermore.

by title.[1] The instructors in their future outline making may also find it most convenient to use these numbers. This will save both time and space.

C. Library card indexes.—At the pleasure of the school officers, card indexes by authors and by titles may be made. The author index may then be arranged alphabetically by names; and the title index may be alphabetically arranged by subjects, such as "Dairying," "Vegetable Growing," and "Fruit Growing." In such a case, the books, bulletins, and reports themselves would remain in the numerical order here adopted, and each card would bear the number assigned the particular title in these lists. Any book, for example, could thus be found instantly; and, after use, could be returned to its proper place by simply looking at its number.

D. Future entries.—Gaps in the numbering have been left for the possible addition of future entries. Missing numbers, however, will occasion no confusion. The simple numerical order may determine the arrangement, even though now and then a gap may appear between entries. After the vacant numbers have all been assigned, still further additions may be made at will by aid of points. Next entry numbers may then be written, for example, as follows: 4.1, 4.2, etc., or 9.1, 9.2, etc., or 49.1, 49.2, 49.3, etc.

(6) **Reference letters.**—The letters following the titles refer to the corresponding letters at the left of the names of the publishers of the respective entries. Needless repetition of the full names and addresses of publishers is thus avoided. A complete list of the publishers and their addresses immediately follows the reference lists. (See pp. 93–94.)

(7) **State help and approval.**—The agent of the board of education for agricultural education will from year to year advise Massachusetts instructors who need his help in making approved selections from these lists, and in the numbering, indexing, and arrangement of agricultural library materials.

4. AGRICULTURAL PROJECT STUDY BIBLIOGRAPHY, ARRANGED FOR READY REFERENCE.[2]

I. *Text-books approved for first and second year agricultural survey.*[3]

1. Mann, A. R. Beginnings in agriculture. (N[4]) 60 cents net.

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2. Mayne and Hatch. High-school agriculture. (BBB)

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[1] See Bulletins of the Board of Education, No. 5, 1912, and No. 9, 1913.

[2] Where more than one entry appears under the headings marked by Romal numerals, the entries above the dotted lines are arranged alphabetically by authors, by States, or by governments, divisions, bureaus, or offices. Space below the dotted lines is reserved for additions to the original entries which have been, or may be, made from time to time.

[3] The textbooks named were chosen for Massachusetts schools. They are not necessarily the best for all other States.

[4] The letters in parentheses are those assigned the various publishers. For the list of publishers and their addresses to which these letters refer, see pp. 93–94.

II. *Text-books approved for third and fourth year agricultural survey.*[1]

5. Warren, G. F. Elements of agriculture. (N) $1.10 net.

6. Warren, G. F. Farm management. (N)
7. Harper, M. W. Animal husbandry for schools. (N)[2]

III. *For first and second year study of projects in—*

1. Vegetable growing.

10. Allen, C. L. Cabbages, cauliflower, etc. (O) 50 cents.
11. Bailey, L. H. Manual of gardening. (N) $2 net.
12. Beattie, W. R. Celery (Farmers' Bul. 282). (Bb)
13. Beattie, W. R. The home vegetable garden (Farmers' Bul. 255). (Bb)
14. Beattie, W. R. Home production of onion seed and sets (Farmers' Bul. 434). (Bb)
15. Beattie, W. R. Onion culture (Farmers' Bul. 354). (Bb)
16. Bennett, Ida D. The vegetable garden. (P) $1.50 net.
17. Corbett, L. C. Beans (Farmers' Bul. 289). (Bb)
18. Corbett, L. C. Cabbage (Farmers' Bul. 433). (Bb)
19. Corbett, L. C. Cucumbers (Farmers' Bul. 254). (Bb)
20. Corbett, L. C. Tomatoes (Farmers' Bul. 220). (Bb)
21. Duggar, B. M. The cultivation of mushrooms (Farmers' Bul. 204). (Bb)
22. Duggar, J. F. Potato culture (Farmers' Bul. 35). (Bb)
23. Fraser, Samuel. The potato. (O) 75 cents.
24. French, Allen. How to grow vegetables. (N) $1.75 net.
25. Fullerton, E. L. How to make a vegetable garden. (P) $2 net.
26. Green, Samuel B. Vegetable gardening. (Q) $1.
27. Greiner, T. How to make the garden pay. (R) $1 net.
28. Handy, R. B. Asparagus culture (Farmers' Bul. 61). (Bb)
29. Hexamer, F. M. Asparagus. (O) 50 cents.
30. Kirkland, A. H. Usefulness of the American toad (Farmers' Bul. 196). (Bb)
31. Massachusetts. Vegetable growing (Mass. State Bd. of Agr. Bul. 5). (C)
32. Morse, J. E. The new rhubarb culture. (O) 50 cents.
33. Rexford, E. E. The home garden. (S) $1.25 net.
34. Roberts, Harry. The beginner's book of gardening. (T) $1 net.
35. Schoene, W. J. Cabbage seed beds, protection (N. Y. State Bul. 334). (L)
36. Sevey, G. C. Bean culture. (O) 50 cents.
37. Sevey, G. C. Peas and pea culture. (O) 50 cents net.
38. Vilmorin-Andrieux. The vegetable garden. (U) $3.75 net.
39. Watts, R. L. Vegetable gardening. (O) $1.75 net.
40. Wicks, W. H. Vegetable garden. (V)

41. Meier, W. H. D. School and home gardens. (CC)
42. Grubb & Guilford, The potato. (P)

2. Small-fruit growing.

(See also Reference No. 41.)

50. Card, Fred W. Bush fruits. (N) $1.50 net.
51. Corbett, L. C. Cranberry culture (Farmers' Bul. 176). (Bb)
52. Corbett, L. C. The home fruit garden preparation and care (Farmers' Bul. 154). (Bb)
53. Corbett, L. C. Pruning (Farmers' Bul. 181). (Bb)
54. Corbett, L. C. Raspberries (Farmers' Bul. 213). (Bb)

[1] The textbooks named were chosen for Massachusetts schools. They are not necessarily the best for all other States.

[2] One of the entries added after publication of the original list. See above (5), D, also foregoing footnote on p. 75.

55. Corbett, L. C. Strawberries (Farmers' Bul. 198). (Bb)
56. Green, S. B. Popular fruit growing. (Q) $1.
57. Husmann, G. C. Grape propagation, pruning, and training (Farmers' Bul. 471). (Bb)
58. Massachusetts. Small fruits and berries (Mass. State Bd. of Agr. Bul. 4). (C)
59. Maynard, S. T. Successful fruit culture. (O) $1.
60. Ragan, W. H. The home vineyard, with special reference to northern conditions (Farmers' Bul. 156). (Bb)
61. Ragan, W. H. Varieties of fruits recommended for planting (Farmers' Bul. 208). (Bb)
62. Rhode Island. Bush fruits (R. I. Exp. Sta. Bul. 91). (M)
63. Waugh, F. A. Fruit: Harvesting, storing, and marketing. (O) $1.
64. White, J. J. Cranberry culture. (O) $1.

3. Beekeeping.

70. Benton, Frank. Beekeeping (Farmer's Bul. 59). (Bb)
71. Comstock, A. B. How to keep bees. (P) $1.
72. Phillips, E. F. Bees (Farmers' Bul. 447). (Bb)
73. Root, A. I. and E. R. The A B C and X Y Z of bee culture. (W) $1.50 net.

4. Poultry keeping.

80. American Poultry Association. The American standard of perfection. (X)
81. Beale, Stephen. Profitable poultry keeping. (Y) $1.
82. Bell, G. A. Poultry management (Farmers' Bul. 287). (Bb)
83. Boyer, M. K. Money in broilers and squabs. (Z) 50 cents.
84. Brigham, A. A. Progressive poultry culture. (AA) $1.50 net.
85. Brown, Edward. Poultry keeping as an industry for farmers and cottagers. (BB) 6s.
86. Connecticut. Water glass: A preservative for eggs (Storrs Bul. 67). (H)
87. Howard, G. E. Standard varieties of chickens (Farmers' Bul. 51). (Bb)
88. Howard, G. E. Ducks and geese: Standard varieties and management (Farmers' Bul. 64). (Bb)
89. Langworthy, C. F. The guinea fowl and its use as food (Farmers' Bul. 234). (Bb)
90. Massachusetts. Poultry culture. (C)
91. McGrew, T. F. Turkeys (Farmers' Bul. 200). (Bb)
92. Pearl, Raymond. Methods of poultry management at the Maine Agricultural Experiment Station. (Bb)
93. Powell, E. C. Making poultry pay. (O) $1.
94. Rhode Island. The rearing and management of turkeys, with special reference to the blackhead disease (R. I. Exp. Sta. Bul. 1[illegible] (M)
95. Rice, Wm. E. Squab raising (Farmer's Bul. 177). (B[illegible]
96. Robinson, J. H. Principles and practice of poultry culture. (CC) $2 net.
97. Sands, R. B. American poultry culture. (MMMM) $1.25.
98. Slocum, R. R. Capons and caponizing (Farmers' Bul. 452). (Bb)
99. Slocum, R. R. Marketing eggs through the creamery (Farmers' Bul. 445). (Bb)
100. Stoddard, H. H. The new egg farm. (O) $1.
101. Valentine, C. S. How to keep hens for profit. (N) $1.50 net.
102. Watson, G. C. Farm poultry. (N) $1.25 net.
103. Wood, R. H. Incubation and incubators (Farmers' Bul. 236). (Bb)
104. Wright, Lewis. The practical poultry keeper. (DD) 87 cents.

105. Howard & McGrew. Perfected poultry. (PPPP)
106. Lewis, H. R. Productive poultry husbandry. (S)
107. Robinson, J. H. Poultry craft. (QQQQ)
108. Various authors. The poultry book. (P)

5. Sheep and goat husbandry.

110. Craig, J. A. Sheep feeding (Farmers' Bul. 49). (Bb)
111. Curtiss, C. F. Raising sheep for mutton (Farmers' bul. 96). (Bb)
112. Thompson, G. F. The angora goat (Farmers' Bul., 137). (Bb)
113. Wing, J. E. Sheep farming in America. (EE) $1.
114. Wing, J. E., *et al.* The winter lamb. (FF)

6. Swine husbandry.

120. Coburn, F. D. Swine in America. (O) $2.50 net.
121. Craig, R. A. Diseases of swine. (O) 75 cents.
122. Dietrich, Wm. Swine. (GG) $1.50
123. Rommel, G. M. Pig management (Farmer's Bul. 205). (Bb)

7. Ornamental planting.

(See also References Nos. 34, 41.)

130. Bennett, I. D. The flower garden. (P) $1.10 net.
131. Corbett, L. C. Annual flowering plants (Farmers' Bul. 195). (Bb)
132. Corbett, L. C. Beautifying the home grounds (Farmer's Bul. 185). (Bb)
133. Corbett, L. C. The lawn (Farmers' Bul. 248). (Bb)
134. Ely, H. R. The practical flower garden. (N) $2.
135. Fernow, B. E. The care of trees in lawn, street, and park. (HH) $2.
136. Hall, Wm. L. Tree planting on rural school grounds (Farmers' Bul. 134). (Bb)
137. Howard, L. O. Three insect enemies of shade trees (Farmers' Bul. 99). (Bb)
138. Kirkgaard, John. A guide for the gardener. (II) $2.50 net.
139. Maynard, S. T. Landscape gardening as applied to home decoration. (JJ) $1.50.
140. Miller, Wilhelm. What England can teach us about gardening. (P) $4 net.
141. Pinchot, Gifford. Arbor day (U. S. Forest Service Circ. 96). (Bg)
142. Sedgwick, Mabel C. The garden month by month. (KK) $4.04 net.
143. Start, E. A., *et al.* Shade trees. (D)
144. Waugh, F. A. Landscape gardening. (O) 50 cents.

IV. *For third and fourth year study of projects in—*

1. Animal husbandry.

(See also references above, No. 70f, No. 80f, No. 110f, and No. 120f.)

150. Adams, J. W. Horseshoeing (Farmers' Bul. 179). (Bb)
151. Alvord, H. E. Breeds of dairy cattle (Farmers' Bul. 106). (Bb)
152. Alvord, H. E. The dairy herd: Its formation and management (Farmers' Bul. 55). (Bb)
153. Brooks, W. P. The hay crop (Mass. Agr. Exp. Sta., Bul. 134). (D)
154. Brooks, W. P. Seeding mowings (Mass. Agr. Exp. Sta. Circ. 27). (D)
155. Brown, Edgar. Alfalfa seed (Farmers' Bul. 194). (Bb)
156. Brown, E., *et al.* Seed of red clover and its impurities (Farmers' Bul. 260). (Bb)
157. Carrier, L. Cost of filling silos (Farmers' Bul. 292). (Bb)
158. Clinton, L. A. Corn growing in New England (Mass. State Bd. of Agr.). (C)
159. Coburn, F. D. Alfalfa. (O) 50 cents.
160. Connecticut. Quality of milk affected by common dairy practices (Storrs Bul. 42). (H)
161. Connecticut. Milking machines (Storrs Bul. 47). (H)
162. Craig, J. A. Judging live stock. (LL) $1.50.
163. Derr, H. B. Barley: Growing the crop (Farmers' Bul. 443). (Bb)
164. Dondlinger, P. T. The book of wheat. (O) $2 net.
165. Duvel, J. W. T. The germination of seed corn (Farmers' Bul. 253). (Bb)

166. Gurler, H. B. The farm dairy. (EE) $1.
167. Hartley, C. P. Corn growing (Farmers' Bul. 199). (Bb)
168. Hartley, C. P. Corn cultivation (Farmers' Bul. 414). (Bb)
169. Hartley, C. P. Harvesting and storing corn (Farmers' Bul. 313). (Bb)
170. Hartley, C. P. The production of good seed corn (Farmers' Bul. 229). (Bb)
171. Hartley, C. P. Seed corn (Farmers' Bul. 415). (Bb)
172. Hickman, R. W. The dehorning of cattle (Farmers' Bul. 350). (Bb)
173. Hillman, F. H. The adulteration of forage plant seeds (Farmers' Bul. 382). (Bb)
174. Illinois. Four systems of dairy farming and the profit on each (University of Ill. Circ. 151). (MM)
175. Johnstone, J. H. S. The horse book. (EE) $2.
176. Lane, C. B. Business of dairying. (O) $1.25 net.
177. Langworthy, C. F. Principles of horse feeding (Farmers' Bul. 170). (Bb)
178. Lindsey, J. B Green crops for summer soiling (Mass. Agr. Exp. Sta. Bul. 133). (D)
179. Lyon and Montgomery. Examining and grading grains. (CC) 48 cents net.
180. Maine. Practical horticulture. Red clover (Maine Bul. 113). (I)
181. Massachusetts. Grasses and forage crops (Mass. St. Bd. of Agr. Bul. 3). (C)
182. Michels, John. Dairy farming. (NN) $1.
183. Moore, G. T., *et al.* Beneficial bacteria for leguminous crops (Farmers' Bul. 214). (Bb)
184. Myrick, Herbert. The book of corn. (O) $1.50.
185. Oakley, R. A. Canada bluegrass (Farmers' Bul. 402). (Bb)
186. Piper, C. V. Leguminous crops for green manuring (Farmers' Bul. 278). (Bb)
187. Plumb, C. S. Indian corn culture. (EE) $1.
188. Plumb, C. S. Silos and silage (Farmers' Bul. 32). (Bb)
189. Plumb, C. S. Types and breeds of farm animals. (CC) $1.60 net.
190. Rhode Island. Corn selection (R. I. Exp. Sta. Bul. 116). (M)
191. Roberts, I. P. The horse. (N) $1.25 net.
192. Saunders, W. D., *et al.* Dairy herd records (Virginia Bul. 190). (DD)
193. Shaw, Thos. Canadian field peas (Farmers' Bul. 224). (Bb)
194. Shaw, Thos. Rape plant, its history, culture, and uses (Farmers' Bul. 11). (Bb)
195. Shaw, Thos. Clovers. (O) $1 net.
196. Shaw, Thos. Forage crops other than grasses. (O) $1.
197. Shaw, Thos. Grasses and how to grow them. (Q) $1.50.
198. Shaw, Thos. Soiling crops and the silo. (O) $1.50.
199. Van Norman, H. E. First lessons in dairying. (O) 50 cents net.
200. Vinall, H. N. Meadow fescue (Farmers' Bul. 361). (Bb)
201. Voorhees, Ed. B. Forage crops. (N) $1.50 net.
202. Warburton, C. W. Oats: Growing the crop (Farmers' Bul. 424). (Bb)
203. Warburton, C. W. Oats—Sixty Day and Kherson (Farmers' Bul. 395). (Bb)
204. Westgate, J. M. Alfalfa (Farmers' Bul. 339). (Bb)
205. Westgate, J. M., *et al.* Red clover (Farmers' Bul. 455). (Bb)
206. Williams, T. A. Millets (Farmers' Bul. 101). (Bb)
207. Zintheo, C. J. Corn-harvesting machinery (Farmers' Bul. 303). (Bb)

208. Harper, M. W. Training and breaking of horses. (N) $1.75.
209. Rose, Laura. Farm dairying. (MMMM) $0.25.
210. Harper, M. W. Manual of farm animals. (N)
211. Willoughby, T. F. The golden stream. (RRRR)
212. Eckles, C. H. Dairy cattle and milk production. (N)
213. Sheldon, J. P. The farm and dairy. (SSSS)
214. Montgomery, E. G. Corn crops. (N) $1.60.

2. Fruit growing.

(See also references under III, 2.)

220. Bailey, L. H. The nursery book. (N) $1.50 net.
221. Bailey, L. H. The principles of fruit growing. (N) $1.50 net.
222. Bailey, L. H. The pruning book. (N) $1.50 net.
223. Brackett, G. B. The apple and how to grow it (Farmers' Bul. 113). (Bb)
224. Connecticut. Apple growing in New England, Parts I and II (Storrs Bul. 61). (H)
225. Connecticut. Apple growing in New England, Part III (Storrs Bul. 62). (H)
226. Connecticut. Apple growing in New England, Part IV (Storrs Bul. 66). (H)
227. Massachusetts. Orcharding (Mass. State Bd. of Agr. Bul. 2). (C)
228. Moore, J. G. Orchards, management (Wisconsin Bul. 201). (PP)
229. Nielsen, H. T. Cowpeas (Farmers' Bul. 318). (Bb)
230. Piper, C. V., *et al.* Soy beans (Farmers' Bul. 372). (Bb)
231. Rhode Island. Improving an orchard (R. I. Exp. Sta. Bul. 83). (M)
232. Thomas, J. J. The American fruit culturist. (O) $2.50 net.
233. Waugh, F. A. The American apple orchard. (O) $1 net.
234. Wolverton, L. The Canadian apple grower's guide. (QQ) $2 net

235. Waugh, F. A. Beginner's guide to fruit growing.

3. Market gardening.

(See also references under III, 1.)

250. Bailey, L. H. The forcing book. (N) $1.25 net.
251. Beattie, W. R. Celery culture. (O) 50 cents.
252. Beattie, W. R. Frames as a factor in truck growing (Farmers' Bul. 460). (Bb)
253. Corbett, L. C. The potato as a truck crop (Farmers' Bul. 407). (Bb)
254. Rawson, Herbert. Success in market gardening. (P) $1.10.
255. Rhode Island. Soil treatment in greenhouse culture (R. I. Exp. Sta. Bul. 107). (M)
256. Rhode Island. A further study of soil treatment in greenhouse culture (R. I. Exp. Sta. Bul. 128). (M)
257. Taft, L. R. Greenhouse construction. (O) $1.50.
258. Taft, L. R. Greenhouse management. (O) $1.50.

V. For laboratory exercises and scientific data bearing upon the productive projects undertaken.

Intended to be supplementary to the entries above given and to be drawn upon as occasion permits or demands. Arrangement alphabetical.

1. Agriculture in general.

270. Bailey, L. H. Cyclopedia of American agriculture: Farms, Vol. I. (N) $5 net.
271. Bailey, L. H. Cyclopedia of American agriculture: Crops, Vol. II. (N) $5 net.
272. Bailey, L. H. Cyclopedia of American agriculture: Animals, Vol. III. (N) $5 net.
273. Bailey, L. H. Cyclopedia of American agriculture: Farm and community, Vol. IV. (N) $5 net.
274. Bailey, L. H. Farm and garden rule book. (N) $2.
275. Bailey, L. H. Principles of agriculture. (N) $1.25 net.
276. Bailey, L. H. Principles of vegetable gardening. (N) $1.50 net.
277. Boss, Andrew. Meat on the farm (Farmers' Bul. 183). (Bb)
278. Brooks, W. P. Agriculture: Soils, Vol. I. (RR) $1.25.
279. Brooks, W. P. Agriculture: Manures, fertilizers, and farm crops, Vol. II. (RR) $1.25.
280. Brooks, W. P. Agriculture: Animal husbandry. (RR) $1.25.

281. Davenport, E. Domesticated animals and plants. (CC) $1 net.
282. Dorset, M. Some common disinfectants (Farmers' Bul. 345). (Bb)
283. Ewell, E. E. Every farm an experiment station (U. S. Dept. of Agr. Yearbook, 1897). (B)
284. Garriot, E. B. Notes on frost (Farmers' Bul. 104). (Bb)
285. Goodrich, C. L. The first book of farming. (P) $1 net.
286. Hunt, T. F. The cereals of America. (O) $1.75.
287. Hunt, T. F. Forage and fiber crops in America. (O) $1.75.
288. Lantz, D. E. How to destroy rats (Farmers' Bul. 369). (Bb)
289. Massey, W. F. Practical farming. (MMMM) $1.50 net.
290. Voorhees, E. B. First principles of agriculture. (TT) 60 cents net.
291. Warburton, C. W. Oats: Distribution and uses (Farmers' Bul. 420). (Bb)
292. Wilcox, E. V. Farmers' cyclopedia of agriculture. (O) $3.50.
293. Williams, F., jr. Clearing new land (Farmers' Bul. 150). (Bb)

294. Hopkins, C. G., *et al.* For better crops. (RRRR)

2. Alcohol, industrial.

300. Wente, A. O., *et al.* Potato culls as a source of industrial alcohol (Farmers' Bul. 410). (Bb)
301. Wiley, H. W. Industrial alcohol: Sources and manufacture (Farmers' Bul. 268). (Bb)
302. Wiley, H. W. Industrial alcohol: Uses and statistics (Farmers' Bul. 269). (Bb)
303. Wiley, H. W., *et al.* Industrial alcohol (Farmers' Bul. 429). (Bb)

3. Animal diseases.

310. Connecticut. Bacillary white diarrhea of young chicks, second report (Storrs Bul. 68). (H)
311. Dorset, M. Hog cholera (Farmers' Bul. 379). (Bb)
312. Maine. Poultry diseases (Maine, Bul. 398). (I)
313. Mayo, N. S. Diseases of animals. (N) $1.50 net.
314. Mayo, N. S. Diseases of pigs (Virginia Bul. 189). (OO)
315. Mohler, J. R. Milk fever: Its simple and successful treatment (Farmers' Bul. 206). (Bb)
316. Mohler, J. R. The tuberculin test of cattle for tuberculosis (Farmers' Bul. 351). (Bb)
317. Phillips, E. F. The treatment of bee diseases (Farmers' Bul. 422). (Bb)
318. Reynolds, M. H. Veterinary studies for agricultural students. (N) $1.75 net.
319. Rhode Island. A biological study of 11 pathogenic organisms from cholera-like diseases in poultry (R. I. Exp. Sta. Bul. 146). (M)
320. Rhode Island. Blackhead in turkeys: A study in avian coccidiosis (R. I. Exp. Sta. Bul. 141). (M)
321. Rhode Island. Further experiments in connection with the blackhead disease (R. I. Exp. Sta. Bul. 124). (M)
322. Rhode Island. Goose septicemia (R. I. Exp. Sta. Bul. 86). (M)
323. Salmon, D. E. Diseases of poultry. (UU) 60 cents net.
324. Salmon, D. E. Scab in sheep (Farmers' Bul. 159). (Bb)
325. United States. Tuberculosis (Farmers' Bul. 473). (Bb)

4. Animal foods and feeding.

335. Allen, E. W. The feeding of farm animals (Farmers' Bul. 22). (Bb)
336. Armsby, H. P. The computation of rations for farm animals by the use of energy value (Farmers' Bul. 346). (Bb)
337. Burns, J. C. Feeding experiments with pigs (Texas Bul. 131). (VV)

338. Connecticut. Pig-feeding experiments (Storrs Bul. 39). (H)
339. Connecticut. The facility of digestion of foods a factor in feeding (Storrs Bul. 43). (H)
340. Connecticut. The cost of feeding heifers (Storrs Bul. 63). (H)
341. Esten, W. M., *et al.* Silage fermentation (Storrs Bul. 70). (H)
342. Henry, W. A. Feeds and feeding. (WW) $2 net.
343. Holland, E. B. Glossary of fodder terms (Hatch Exp. Sta. Bul. 33). (D)
344. Jeffrey, J. S. Feeding experiments with poultry (N. C. College Agr. Exp. Sta. Bul. 211). (XX)
345. Jordan, W. H. The feeding of animals. (N) $1.50 net.
346. Rhode Island. Feeding experiments with chickens, cockerels, and turkeys (Agr. Exp. Sta. Bul. 126). (M)
347. Rice, J. E., *et al.* Feeding experiments with young chickens (Cornell Bul. 282). (K)
348. Shaw, Thos. Feeding farm animals. (O) $2.
349. Smith, P. H., *et al.* Inspection of commercial feedstuffs (Mass. Agr. Exp. Sta. Bul. 139). (D)

5. Animal life, propagation and tests.

360. Kellogg, V. L. Animals. (YY) $1.80 net.
361. Jordan, D. S., *et al.* Animal studies. (YY) $1.25 net.
362. Oldys, H. Pheasant raising in the United States (Farmers' Bul. 390). (Bb)
363. Punnett, R. C. Mendelism. (N) $1.25.
364. Shaw, Thos. Animal breeding. (O) $1.50.
365. Stabler, A. L. Feeding experiments with pigs (Md. College Park Agr. Exp. Sta. Bul. 150). (ZZ)

366. Peabody and Hunt. Elementary biology: Animal and human. (N)

6. Bacteriology, agricultural.

370. Conn, H. W. Agricultural bacteriology. (AAA) $2 net.
371. Conn, H. W. Bacteria in milk and its products. (AAA) $1.50 net.
372. Conn, H. W. Practical dairy bacteriology. (O) $1.25.
373. Connecticut. Bacterium lactis acidi and its sources (Storrs Bul. 59). (H)
374. Connecticut. Comparative studies with covered milk pails (Storrs Bul. 48). (H)
375. Harding, H. A., *et al.* Milk pails, covered, tests (N. Y. State Bul. 326). (L)
376. Lipman, J. G. Bacteria in relation to country life. (N) $1.50 net.
377. Rogers, L. A. Bacteria in milk (Farmers' Bul. 348). (Bb)

7. Birds and agriculture.

385. Beal, F. E. L. Some common birds in their relation to agriculture (Farmers' Bul. 54). (Bb)
386. Dearborn, Ned. How to destroy English sparrows (Farmers' Bul. 383). (Bb)
387. Forbush, E. H. Useful birds and their protection (Mass. Bd. of Agr.). (C)
388. McAtee, W. L. Our grosbeaks and their value to agriculture (Farmers' Bul. 456). (Bb)

8. Botany and plant physiology.

395. Andrews, E. F. Practical course in botany. (BBB) $1 net.
396. Bergen, J. Y., *et al.* Practical botany. (CC) $1.04 net.
397. Coulter, J. M. Plant structures. (YY) $1.20 net.
398. Duggar, B. M. Plant physiology. (N) $1.60 net.
399. Percival, J. Agricultural botany. (HH) $2.50 net.
400. Stevens, W. C. Introduction to botany. (CCC) $1.50 net.

401. Atkinson, F. A. Botany. (HH)

9. Chemistry and agriculture.

405. Hart, E. B., *et al.* General agricultural chemistry. (DDD) $1.50.
406. Storer, F. H. Agriculture in some of its relations with chemistry, Vol. I. (EEE) $5 for set of three volumes.
407. Storer, F. H. Agriculture in some of its relations with chemistry, Vol. II. (EEE) $5 for set of three volumes.
408. Storer, F. H. Agriculture in some of its relations with chemistry, Vol. III. (EEE) $5 for set of three volumes.
409. Warington, R. The chemistry of the farm. (FFF) $1.13.
410. Williams, R. P. Elements of chemistry. (CC) 88 cents net.

10. Construction and repairs: Plans, materials, tests, etc.

415. Alleman, G. Quantity and character of creosote in well-preserved timbers (Forest Service Circ. 98). (Bg)
416. Atwood, H. Poultry houses, construction (W. Va. Bul. 130). (GGG)
417. Beattie, W. R. The repair of farm equipment (Farmers' Bul. 347). (Bb)
418. Cobleigh, R. Handy farm devices. (O) $1.50 net.
419. Breeders' Gazette. Farm buildings. (GG) $2.
420. Corbett, L. C. Ice houses (Farmers' Bul. 475). (Bb)
421. Cushman, A. S. The corrosion of fence wire (Farmers' Bul. 239). (Bb)
422. Davidson and Chase. Farm buildings. (NNNN) $2.
423. Fiske, G. B. Poultry appliances and handicrafts. (NNNN) 50 cents.
424. Fiske, G. B. Poultry architecture. (NNNN) 50 cents.
425. Hasluck, P. N. Harness making. (NNNN)
426. Hasluck, P. N. Knotting and splicing. (NNNN)
427. Hasluck, P. N. Saddlery. (NNNN)
428. Hill, G. G. Farm buildings, practical suggestions for (Farmers' Bul. 126). (Bb)
429. Holmstrom, J. G. Standard blacksmithing, horseshoeing, and wagon making. (Q) 50 cents.
430. Orange Judd Co. Barn plans and outbuildings. (O) $1.
431. Rice, J. E., *et al.* Poultry appliances, labor-saving (Cornell Bul. 284). (K)
432. Stabler, A. L. Hog houses, description. (ZZ)
433. United States. The construction of concrete fence posts (Farmers' Bul. 403). (Bb)
434. United States. The use of concrete on the farm (Farmers' Bul. 461). (Bb)
435. Walker, P. H. The use of paint on the farm (Farmers' Bul. 474). (Bb)
436. Warren, J. A. Hog houses (Farmers' Bul. 438). (Bb)
437. Willis, C. P. The preservative treatment of farm timbers (Farmers' Bul. 387). (Bb)
438. Wormeley, P. L. Cement mortar and concrete: Preparation and use for farm purposes (Farmers' Bul. 235). (Bb)

11. Dairy products and manufactures.

445. Alvord, H. E. Cheese making on the farm (Farmers' Bul. 166). (Bb)
446. Connecticut. The camembert type of soft cheese in the United States (Storrs Bul. 35). (H)
447. Connecticut. Directions for making the camembert type of cheese (Storrs Bul. 46). (H)
448. Farrington and Woll. Testing milk and its products. (HHH) $1.25.
449. Mortensen, M. Creamery bookkeeping (Iowa Bul. 121). (II)
450. Trueman, J. M. Butter making on the farm (Storrs Bul. 65). (H)
451. Van Slyke, L. L. Modern methods of testing milk and milk products. (O) 75 cents.

452. Washburn, R. M. Ice-cream making, principles and practice (Vermont Bul. 155). (JJJ)
453. Webster, E. H. Butter making on the farm (Farmers' Bul. 241). (Bb)
454. Wing, H. H. Milk and its products. (N) $1.50 net.

455. Snyder, H. Dairy chemistry. (N)
456. Barthel, Chr. Milk and dairy products. (N) $2.25.
457. McKay and Larson. Principles and practice of butter making.

12. Farm management and rural economics.

Accounts, statistics, etc.

460. Andrews, F. Costs of hauling crops from farms to shipping points (Bureau of Stat. Bul. 49). (Bc)
461. Arnold, J. H. How a city family managed a farm (Farmers' Bul. 432). (Bb)
462. Blodgett, J. H. Relations of population and food products in the United States, etc. (Div. of Stat. Bul. 24). (Bd)
463. Blodgett, J. H. Wages of farm labor in the United States (Bureau of Stat. Bul 26). (Bc)
464. Burritt, M. C. A successful New York farm (Farmers' Bul. 454). (Bb)
465. Card, F. W. Farm management. (P) $2 net.
466. Carrier, L. A profitable tenant dairy farm (Farmers' Bul. 280). (Bb)
467. Carver, T. N. Principles of rural economics. (QC) $1.04 net.
468. Clark, C. C. Wheat crops of the United States, 1866–1906 (Bureau of Stat. Bul. 57). (Bc)
469. Clark, C. C. Oat crops of the United States, 1866–1906 (Bureau of Stat. Bul. 58). (Bc)
470. Clark, C. C. Rye crops of the United States, 1866–1906 (Bureau of Stat. Bul. 60). (Bc)
471. Clark, C. C. Buckwheat crops of the United States, 1866–1906 (Bureau of Stat. Bul. 61). (Bc)
472. Clark, C. C. Potato crops of the United States, 1866–1906 (Bureau of Stat. Bul. 62). (Bc)
473. Clark, C. C. Hay crops of the United States, 1866–1906 (Bureau of Stat. Bul. 63). (Bc)
474. Clothier, G. L. Forest planting and farm management (Farmers' Bul. 228). (Bb)
475. Covert, J. R. Dates of sowing and harvesting (Bureau of Stat. Circ. Letter) (Bc)
476. Dodge, L. G. Cropping systems for New England dairy farms (Farmers' Bul. 637). (Bb)
477. Dodge, L. G. Farm management in northern potato-growing sections (Farmers' Bul. 365). (Bb)
478. Hill, G. G. Marketing farm produce (Farmers' Bul. 62). (Bb)
479. Hitchcock, F. H. Trade of Denmark (Sec. of For. Mkts. Bul. 9). (Be)
480. Hitchcock, F. H. Our trade with Spain, 1888–1897 (Sec. of For. Mkts. Bul. 12). (Be)
481. Hitchcock, F. H. Our trade with Japan, China, and Hongkong, 1889–1899 (Sec. of For. Mkts. Bul. 18). (Be)
482. Hitchcock, F. H. Our trade with Scandinavia, 1890–1900 (Sec. of For. Mkts. Bul. 22). (Be)
483. Hitchcock, F. H. Sources of agricultural imports of the United States (Sec. of For. Mkts. Bul. 24). (Be)
484. Hitchcock, F. H. Agricultural exports of the United States, 1896–1900 (Sec. of For. Mkts. Bul. 25). (Be)

485. Hitchcock, F. H. Agricultural imports of the United Kingdom, 1896–1900 (Sec. of For. Mkts. Bul. 26). (Be)
486. Hitchcock, F. H. Sources of the agricultural imports of the United States, 1897–1901 (Sec. of For. Mkts. Bul. 28). (Be)
487. Hitchcock, F. H. Agricultural exports of the United States, 1851–1902 (Div. of For. Mkts. Bul. 34). (Bd)
488. Holmes, G. K. Local conditions as affecting farm values, 1900–1905 (Bur. of Stat. Bul. 44). (Bc)
489. Hunt, T. F. How to choose a farm. (N) $1.55.
490. McClure, H. B. Conditions affecting the value of market hay (Farmers' Bul. 362). (Bb)
491. Peters, E. T. Cooperative credit associations in certain European countries (Div. of Stat. Report 3). (Bd)
492. Roberts, I. P. The farmer's business handbook. (N) $1.25.
493. Roberts, I. P. The farmstead. (N) $1.50.
494. Smith, C. B. Clover farming on the sandy jack-pine lands of the North (Farmers' Bul. 323). (Bb)
495. Smith, C. B., *et al.* Replanning a farm for profit (Farmers' Bul. 370). (Bb)
496. Spillman, W. J. An example of modern farming (Farmers' Bul. 242). (Bb)
497. Spillman, W. J. A successful hog and seed-corn farm (Farmers' Bul. 272). (Bb)
498. Spillman, W. J. A successful poultry and dairy farm (Farmers' Bul. 355). (Bb)
499. Taylor, H. C. Agricultural economics. (N) $1.25.
500. Terry, T. B. Our farming, or, How we have made a run-down farm bring both profit and pleasure. (KKK) 75 cents.
501. United States. The world's markets for American products. Great Britain and Ireland (Sec. For. Mkts. Bul. 1). (Be)
502. United States. The world's markets for American products. Great Britain and Ireland (Sec. For. Mkts. Bul. 1, Supp.). (Be)
503. United States. The world's markets for American products, German Empire (Sec. For. Mkts. Bul. 2). (Be)
504. United States. The world's markets for American products, France (Sec. For. Mkts. Bul. 3). (Be)
505. United States. The world's markets for American products, Netherlands (Sec. of For. Mkts. Bul. 5). (Be)
506. United States. The world's markets for American products, Belgium (Sec. For. Mkts. Bul. 6). (Be)
507. United States. The world's markets for American products, Norway (Sec. of For. Mkts. Bul. 7). (Be)
508. United States. The world's markets for American products, Sweden (Sec. For. Mkts. Bul. 8). (Be)
509. United States. The Manchester district of England as a market for American products (Sec. For. Mkts. Circ. 8). (Be)
510. United States. Hamburg as a market for American products (Sec. For. Mkts. Circ. 14). (Be)
511. United States. Our trade with Cuba from 1887–1897 (Sec. For. Mkts. Circ. 16). (Be)
512. United States. Production and distribution of the principal agricultural products of the world (Div. of Stat. Rep. 5). (Bd)
513. United States. Meat animals and packing-house products imported into 11 principal countries, 1895–1904 (Bur. of Stat. Bul. 40). (Bc)
514. United States. Norway, Sweden, and Russia as markets for packing-house products (Bur. of Stat. Bul. 41). (Bc)
515. United States. Imports of farm and forest products, 1905–1907, by countries from which consigned (Bur. of Stat. Bul. 70). (Bc)

516. United States. Exports of farm and forest products, 1905–1907, by countries to which consigned (Bur. of Stat. Bul. 71). (Bc)
517. United States. Imports of farm products into the United States, 1851–1908 (Bur. of Stat. Bull. 74). (Bc)
518. United States. Exports of farm products from the United States, 1851–1908 (Bur. of Stat. Bul. 75). (Bc)
519. United States. Imports of farm and forest products, 1907–1909, by countries from which consigned (Bur. of Stat. Bul. 82). (Bc)
520. United States. Imports of farm and forest products, 1908–1910, by countries from which consigned (Bur. of Stat. Bul. 90). (Bc)
521. United States. Exports of farm and forest products, 1908–1910, by countries to which consigned (Bur. of Stat. Bul. 91). (Bc)
522. Ward, E. G., jr. Milk transportation: Freight rates to largest 15 cities in United States (Div. of Stat. Bul. 25). (Bd)
523. Ward, E. G., jr. Methods and routes for exporting farm products (Bur. of Stat. Bul. 29). (Bc)
524. Warren, G. F. Laboratory exercises in farm management. (N) 80 cents.
525. Warren, J. A. Small farms in the corn belt (Farmers' Bul. 325). (Bb)
526. Wing, J. E. Alfalfa farming in America. (GG) $2.
527. Woll, F. W. Handbook for farmers and dairymen. (JJ) $1.50.

528. Green, J. B. Law for the American farmer. (N) $1.50.

13. Fruits.

540. Bailey, L. H. The evolution of our native fruits. (N) $2.
541. Kennedy, P. B. Apples, culture in Nevada (Nevada Bul. 72). (LLL)
542. Waugh, F. A. Systematic pomology. (O) $1.

14. Insects.

550. Chittenden, F. H. Insects injurious to vegetables. (O) $1.50.
551. Comstock, J. H., *et al.* Manual for the study of insects. (MMM) $3.75 net.
552. Connecticut. The apple-leaf miner (Storrs Bul. 45). (H)
553. Fernald, H. T. The imported elm-leaf beetle (Hatch Bul. 76). (D)
554. Franklin, H. J. Cranberry insects (Mass. Agr. Exp. Sta. Bul. 115). (D)
555. Mass. State Forester. Colored plates of the gypsy and brown-tail moths and Calosoma beetle (Mass. State Forester Bul. 14). (F)
556. Mass. State Forester. The gypsy and brown-tail moths (Mass. State Forester Bul. 11). (F)
557. Quaintance, A. L., *et al.* Insect and fungous enemies of the grape east of the Rocky Mountains (Farmers' Bul. 284). (Bb)
558. Sanderson, E. D. Insect pests of farm, garden, and orchard. (JJ) $3.
559. Saunders, Wm. Insects injurious to fruits. (S) $2 net.
560. Smith, John. Our insect friends and enemies. (S) $1.50 net.
561. Smith, J. B. Insects injurious in cranberry culture (Farmers' Bul. 178). (Bb)
562. Weed, C. M. Life histories of American insects. (N) $1.50.

15. Lime and liming.

570. Brooks, W. P. Lime, use of, in Massachusetts agriculture (Mass. Agr. Exp. Sta. Circ. 20). (D)
571. Brooks, W. P. Lime, the rational use of (Mass. Agr. Exp. Sta. Bul. 137). (D)
572. Haskins, H. D., *et al.* Lime, the distribution, composition, and cost of (Mass. Agr. Exp. Sta. Bul. 137). (D)
573. Rhode Island. Influence of lime upon plant growth (R. I. Exp. Sta. Bul. 96). (M)
574. Wheeler, H. J. The liming of soils (Farmers' Bul. 77). (Bb)

16. Physics of agriculture.

Drainage, irrigation, machines, motors, etc.

580. Davidson, J. B., *et al.* Farm machinery and farm motors. (O) $2 net.
581. Elliott, C. G. Practical farm drainage. (JJ) $1.50.
582. Elliott, C. G. Drainage of farm lands (Farmers' Bul. 187). (Bb)
583. Johnston, C. T., *et al.* How to build small irrigation ditches (Farmers' Bul. 158). (Bb)
584. King, D. Ward. The use of the slit-log drag on earth roads (Farmers' Bul. 321). (Bb)
585. King, F. H. Irrigation and drainage. (N) $1.50.
586. King, F. H. Physics of agriculture. (NNN) $1.75.
587. Lucke, C. E., *et al.* The use of alcohol and gasoline in farm engines (Farmers' Bul. 277). (Bb)
588. Powell, F. E. Wind-mills and wind motors. (NNNN) 50 cents.
589. Wickson, E. J. Irrigation in field and garden (Farmers' Bul. 138). (Bb)

17. Plant diseases.

(See also Spraying.)

600. Galloway, B. T. Some destructive potato diseases (Farmers' Bul. 15). (Bb)
601. Mass. State Forester. The chestnut bark disease. (F)
602. Massee, Geo. A textbook of fungi. (N) $2.
603. Shear, C. L. Fungous diseases of the cranberry (Farmers' Bul. 221). (Bb)
604. Smith, Eliza H. Blossom end rot of tomatoes (Mass. Agr. Exp. Sta. Tech. Bul. 3). (D)
605. Stevens, F. L., *et al.* Diseases of economic plants. (N)
606. Stone, G. E. Tomato diseases (Mass. Agr. Exp. Sta. Bul. 138). (D)

18. Plant foods and feeding.

(See also Soils, etc.)

615. Aikman, C. M. Manures and manuring. (OOO) $2.50.
616. Beal, W. H. Barnyard manure (Farmers' Bul. 192). (Bb)
617. Brooks, W. P. Fertilizers for potatoes (Mass. Agr. Exp. Sta. Circ. 26). (D)
618. Brooks, W. P. Poultry manures, their treatment and use (Mass. Agr. Exp. Sta. Circ. 22). (D)
619. Cameron, F. K. The soil solution. (PPP) $1.25 net.
620. Close, C. P., *et al.* Asparagus, fertilizer tests (Md. Bul. 151). (ZZ)
621. Haskins, *et al.* Inspection of commercial fertilizers (Mass. Agr. Exp. Sta. Bul. 140). (D)
622. Johnson, S. W. How crops feed. (O) $1.50.
623. Myers, W. S. Food for plants. (QQQ)
624. Rhode Island. Continuous corn culture (R. I. Exp. Sta. Bul. 113). (M)
625. Rhode Island. Further experiments in top-dressing grassland (R. I. Exp. Sta. Bul. 90). (M)
626. Rhode Island. Cooperative experiments in top-dressing grassland (R. I. Agr. Exp. Sta. Bul. 95). (M)
627. Rhode Island. A test of nine phosphates with different plants (R. I. Agr. Exp. Sta. Bul. 114). (M)
628. Rhode Island. The gain in nitrogen during a five-year pot experiment with different legumes (R. I. Agr. Exp. Sta. Bul. 147). (M)
629. Rhode Island. Plant peculiarities as shown by the influence of sodium salts (R. I. Agr. Exp. Sta. Bul. 104). (M)
630. Rhode Island. Concerning the agricultural value of sodium salts (R. I. Agr. Exp. Sta. Bul. 106). (M)

631. Stewart, J. H., *et al.* Field experiments with fertilizers (W. Va. Bul. 131). (GGG)
632. Voorhees, E. B. Commercial fertilizers: Composition and use (Farmer's Bul. 44). (Bb)
633. Voorhees, E. B. Fertilizers. (N) $1.25.

634. Halligan, J. E. Soil fertility and fertilizers. (PPP)

19. Plant life, propagation, and tests.

645. Bailey, L. H. Plant breeding. (N) $1.25.
646. Ballou, F. H., *et al.* Potatoes, culture in Ohio (Ohio Bul. 218). (RRR)
647. Beal, W. J. Seed dispersal. (CC) 35 cents.
648. Corbett, L. C. The propagation of plants (Farmers' Bul. 157). (Bb)
649. Coulter, J. M. Plant studies. (YY) $1.25.
650. Craig, A. G. Potatoes, test of varieties (Washington Bul. 94). (SSS)
651. Gray, Asa. How plants grow. (BBB) 64 cents net.
652. Grubb, E. H. Potato culture on irrigated farms of the West (Farmers' Bul. 386). (Bb)
653. Hinson, W. M., *et al.* Tobacco seed beds, management (Conn. Bul. 166). (GG
654. Johnson, S. W. How crops grow. (O) $1.50.
655. Jones, L. R. Vermont grasses and clovers (Vt. Bul. 94). (JJJ)
656. Jordan, W. H., *et al.* Potatoes, fertilizer tests (N. Y. State Bul. 327). (L)
657. Kennedy, P. B. Alfalfa, test of varieties (Nevada Bul. 72). (LLL)
658. MacDougall, D. T. The nature and work of plants. (N) 80 cents.
659. Maine. Experiments in breeding sweet corn (Maine Bul. 183). (I)
660. Maine. Proper growing and handling of potato "seed" stock (Maine Bul. 435). (I)
661. Masters, M. T. Plant life on the farm. (O) $1.
662. Osterhout, W. J. V. Experiments with plants. (N) $1.25.
663. Rhode Island. Further results in a rotation of potatoes, rye, and clover (R. I. Agr. Exp. Sta. Bul. 135). (M)
664. Rhode Island. Grass experiments (R. I. Agr. Exp. Sta. Bul. 82). (M)
665. Rhode Island. Potatoes (R. I. Agr. Exp. Sta. Bul. 111). (M)
666. Rhode Island. The soy bean (R. I. Agr. Exp. Sta. Bul. 92). (M)
667. Spillman, W. J. Farm grasses of the United States. (O) $1.
668. Sutton & Sons. Culture of vegetables and flowers from seeds and roots. (TTT) $1.25 net.
669. Waugh, F. A. The graft union (Hatch. Bul. (Tech.) No. 2). (D)
670. Willis, C. Alfalfa, test of varieties (S. Dak. Report for 1910). (UUU)

671. Peabody and Hunt. Elementary biology—Plants. (N)
672. Sargent, F. L. Plants and their uses. (HH)

20. Soils, geology, physical geography, soil fertility.

680. Brooks, W. P. The chemical analysis of soils (Mass. Agr. Exp. Sta. Circ. 29). (D)
681. Burkett, C. W. Soils. (O) $1.25.
682. Davis, W. M. Elementary physical geography. (CC) $1 net.
683. Fletcher. Soils. (P) $2 net.
684. Free, E. E., *et al.* The control of blowing soils (Farmers' Bul. 421). (Bb)
685. Gilbert, G. K. An introduction to physical geography. (YY) $1.25 net.
686. Hills, J. L., *et al.* Soil classifications and adaptations (Vt. Bul. 154). (JJJ)
687. King, F. H. The soil. (N) $1.50.
688. McCall, A. G. The physical properties of soils. (O) 50 cents net.
689. Merrill, G. P. Rocks, rock weathering, and soils. (N) $4.
690. Rhode Island. Field experiments on individual farms (R. I. Agr. Exp. Sta. Bul. 148). (M)

691. Roberts, I. P. The fertility of the land. (N) $1.50.
692. Snyder, H. Soils and fertilizers. (N) $1.25.
693. Spillman, W. J. Renovation of worn-out soils (Farmers' Bul. 245). (Bb)
694. Spillman, W. J. Soil conservation (Farmers' Bul. 406). (Bb)
695. Taft, Wm. Conservation of the soil (Circ. 38). (B)
696. Tarr, R. S. Elementary geology. (N) $1.40.
697. Vivian, A. First principles of soil fertility. (O) $1 net.
698. Whitney, M. Soil fertility (Farmers' Bul. 257). (Bb)

699. Lyon, T. L., *et al.* Soils. (N)

21. Spraying and fumigation.

710. Clinton, G. P., *et al.* Spraying experiments (Conn. State Report, 1909–10). (G)
711. Connecticut. Proprietary and home-made miscible oils for the control of the San José scale (Storrs Bul. 54). (H)
712. Connecticut. Petroleum emulsion for the San José scale (Storrs Bul. 49). (H)
713. Galloway, B. T. Potato diseases and their treatment (Farmers' Bul. 91). (Bb)
714. Goodwin, W. H. Spraying machinery (Ohio Bul. 216). (RRR)
715. Hinds, W. E. Carbon bisulphid as an insecticide (Farmers' Bul. 145). (Bb)
716. Howard, L. O. The brown-tail moth and how to control it (Farmers' Bul. 264). (Bb)
717. Howard, L. O. The gypsy moth and how to control it (Farmers' Bul. 275). (Bb)
718. Johnson, Willis G. Fumigation methods. (O) $1.
719. Lodeman, E. G. The spraying of plants. (N) $1.25.
720. Lutman, B. F. Spraying experiments on potatoes (Vt. Bul. 153). (JJJ)
721. Marlatt, C. L., *et al.* The control of the codling moth and apple scab (Farmers' Bul. 247). (Bb)
722. Marlatt, C. L. Important insecticides: Directions for their preparation and use (Farmers' Bul. 127). (Bb)
723. Orton, W. A. Spraying for cucumber and melon diseases (Farmers' Bul. 231). (Bb)
724. Rhode Island. When to spray. Formulas and notes on spraying (R. I. Agr. Exp. Sta. Bul. 100). (M)
725. Scott, W. M., *et al.* Spraying peaches for the control of brown-rot, scab, and curculio (Farmers' Bul. 440). (Bb)
726. Slingerland, M. V., *et al.* Insects, injurious, treatment (Cornell Bul. 283). (K)
727. Stone, G. E., *et al.* Fungicides, insecticides, and spraying directions (Mass. Agr. Exp. Sta. Bul. 123). (D)
728. Swingle, W. T. The prevention of stinking smut of wheat and loose smut of oats (Farmers' Bul. 250). (Bb)
729. Van Slyke, L. L., *et al.* Lime-sulphur wash, preparation (N. Y. State Bul. 329). (L)
730. Waite, M. B. Fungicides and their use in preventing diseases of fruit (Farmers' Bul. 243). (Bb)
731. Wallace, E. Lime-sulphur preparations, injurious effects (Cornell Bul. 288). (K)
732. Weed, C. M. Insects and insecticides. (O) $1.50.
733. Whetzel, H. H. Diseases of plants, treatment (Cornell Bul. 283). (K)

22. Textbooks and manuals for schools.

(Agricultural.)

745. Barto, D. A. Manual of agriculture, soils and crops. (CCC) 50 cents net.
746. Bricker, G. A., *et al.* Agricultural words. (VVV) 5 cents.
747. Burkett, Stevens, and Hill. Agriculture for beginners. (CC) 60 cents net.
748. Corbett, L. C. The school garden (Farmers' Bul. 218). (Bb)

749. Coulter, J. M., *et al.* Practical nature study and elementary agriculture.. (YY) $1.35.
750. Crosby, D. J. School exercises in plant production (Farmers' Bul. 408). (Bb)
751. Crosby, D. J., *et al.* School lessons on corn (Farmers' Bul. 409). (Bb)
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753. Davis, K. C. Productive farming. (S) $1.
754. Duggar, J. F. Agriculture for southern schools. (N) 75 cents.
755. Farrar, H. A. A year of agriculture in a rural Vermont high school (Middlebury Coll. Bul. 5). (WW)
756. Field, Jessie. Farm arithmetic. (XXX) 15 cents.
757. Fisher and Cotton. Agriculture for common schools. (EEE) $1.
758. Fream, W. Elementary agriculture. (U) $1.25 net.
759. Goff, E. S., *et al.* First principles of agriculture. (BBB) 64 cents net.
760. Halligan, J. E. Fundamentals of agriculture. (CCC) $1.25 net.
761. Hatch and Haselwood. Elementary agriculture. (YYY) 50 cents.
762. Hays, W. M. Farm development. (O) $1.50 net.
763. Hillma, F. H. Testing farm seeds in the home and in the rural school (Farmers' Bul. 428). (Bb)
764. Hodge, C. F. Nature study and life. (CC) $1.20 net.
765. Howe, F. W. How to test seed corn in school (Of. of Exp. Sta. Circ. 96). (Ba)
766. Hurd, W. D. Course in agriculture for high schools and academies in Maine. (AAAA)
767. Jackson and Daugherty. Agriculture through the laboratory and school garden. (O) $1.50 net.
768. James, C. J. Practical agriculture. (YY) 80 cents net.
769. Mass. State Forester. The evergreens: Methods of study in public schools (Mass. State Forester Bul. 4). (F)
770. McLennan, J. Manual of practical farming. (N) $1.50.
771. Moore, W. M., *et al.* Forest nurseries for schools (Farmers' Bul. 423). (Bb)
772. Nolan, A. W. One hundred lessons in agriculture. (YYY) 65 cents.
773. Shaw, E. E. Gardening. (P)[1]
774. Shoesmith, V. M. The study of corn. (O) 50 cents net.
775. Soule and Turpin. Agriculture: Its fundamental principles. (ZZZ) 75 cents.
776. Stevens, F. L., *et al.* A practical arithmetic. (EEE) 65 cents.
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778. Warren, G. F. A secondary course in agronomy (Of. of Exp. Sta. Circ. 77). (Ba)
779. Weed, C. M. Farm friends and farm foes. (CCC) 90 cents net.
780. Weed, C. M., *et al.* The school garden book. (EEE) $1.25.
781. Wilkinson, J. W. Practical agriculture. (BBB) 80 cents net.
782. Wilson, A. D., *et al.* Agriculture for young folks. (Q) $1.
783. Winkenwerder, H. A. Forestry in the public schools (U. S. Forest Service Circ. 130). (Bg)

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784. Comstock, A. B. Handbook of nature study. (MMM) $3.05 net.
785. Burkett, C. W., *et al.* Farm arithmetic. (O)
786. Budd, J. L., *et al.* American horticultural manual. (JJ)
787. Call, L. E., *et al.* A laboratory manual of agriculture. (Y)
788. Stebbins, C. A. The principles of agriculture through the school and home garden. (N)
789. Calfee, J. E. Rural arithmetic. (CC)
789.1 Ross. A dairy laboratory guide.

[1] A volume in the "Library of Work and Play," for sale only as a complete set of 10 volumes at $17.50.

23. Trees and shrubs.

Not for fruit.

790. Bates, C. C. Windbreaks (U. S. Forest Service Bul. 86). (Bg)
791. Blakeslee, A. F., *et al.* Trees in winter. (N)
792. Blakeslee, A. F., *et al.* New England trees in winter (Storrs Bul. 69). (H)
793. Gifford, John. Practical forestry. (YY) $1.20.
794. Jones, L. R., *et al.* Vermont shrubs and woody vines (Vt. Bul. 145). (JJJ)
795. Maine. Wood-lot suggestions (Maine Bul. 402). (I)
796. Mass. State Forester. Forest trees of Massachusetts, how you may know them (Mass. State Forester Bul. 1). (F)
797. Mass. State Forester. Massachusetts wood-using industries (Mass. State Forester Bul. 3). (F)
798. Mass. State Forester. Reforestation in Massachusetts (Mass. State Forester Bul. 5). (F)
799. Mass. State Forester. How and when to collect white-pine seed (Mass. State Forester Bul. 6). (F)
800. Mass. State Forester. Forest mensuration of the white pine, how to estimate standing timber (Mass. State Forester Bul. 7). (F)
801. Mass. State Forester. Forest fire-fighting equipment in our towns (Mass. State Forester Bul. 10). (F)
802. Mass. State Forester. How to make improvement thinnings (Mass. State Forester Bul. 8). (F)
803. Pinchot, G. Forest planting (U. S. Forest Service Circ. 61). (Bg)
804. Pinchot, G. A primer of forestry (Farmers' Bul. 173). (Bb)
805. Pinchot, G. A primer of forestry: Part II, practical forestry (Farmers' Bul. 358). (Bb)
806. Spring, S. N. White pine: Natural replacement on old fields in New England (U. S. Bureau of Forestry Bul. 63). (Bh)

24. Weeds and their eradication.

815. Cates, J. S. The eradication of quackgrass (Farmers' Bul. 464). (Bb)
816. Cates, J. S., *et al.* A method of eradicating Johnson grass (Farmers' Bul. 279). (Bb)
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818. Cox, H. R. The eradication of bindweed, or wild morning-glory (Farmers' Bul. 368). (Bb)
819. Dewey, L. H. Weeds and how to kill them (Farmers' Bul. 28). (Bb)
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25. Zoology, general and economic.

(See also above references 360, 361.)

830. Linville, H. R., *et al.* A texthook in general zoology. (CC) $1.20 net.
831. Osborne, H. Economic zoology. (N) $2.

VI. For betterment of country life and education.

835. Abbey, M. J. Normal-school instruction in agriculture (U. S. Of. of Exp. Sta. Circ. 90). (Ba)
836. Anderson, W. L. The country town. (BBBB) $1.
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838. Bailey, L. H. The State and the farmer. (N) $1 25 net.
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841. Brewer, I. W. Rural hygiene. (S) $1.25.
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843. Buell, Jennie. One woman's work for farm women. (DDDD) 50 cents net.
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856. Howard, L. O. How insects affect health in rural districts (Farmers' Bul. 155). (Bb)
857. Howard, L. O. Remedies and preventives against mosquitoes (Farmers' Bul. 444). (Bb)
858. Howard, L. O. Some facts about malaria (Farmers' Bul. 450). (Bb)
859. Howe, F. W. Boys' and girls' agricultural clubs (Farmers' Bul. 385). (Bb)
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861. Kern, O. J. Among country schools. (CC) $1 net.
862. King, F. H. Farmers of 40 centuries. (NNN) $2.50.
863. King, F. H. Ventilation for dwellings, rural schools, and stables. (NNN) 75 cents.
864. Knapp, S. A. Demonstration work on southern farms (Farmers' Bul. 422). (Bb)
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866. McKeever, W. A. Farm boys and girls. (N) $1.50.
867. Miller, M. B. Outdoor work. (P)[1]
868. Page, L. W., *et al.* How to prevent typhoid fever (Farmers' Bul. 478). (Bb)
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873. Snedden, David. The problem of vocational education. (LLLL) 35 cents net.
874. Stiles, C. W., *et al.* The sanitary privy (Farmers' Bul. 463). (Bb)
875. True, A. C., *et al.* The American system of agricultural education (U. S. Of. of Exp. Sta. Circ. 106). (Ba)
876. Williams, Dora. Gardens and their meaning. (CC) 50 cents net.
877. Wilson, E. T. Modern conveniences for the farm homes (Farmers' Bul. 270). (Bb)

[1] A volume in the "Library of Work and Play," for sale only as a complete set of 10 volumes at $17.50.

878. Hunt, Thos. F. The young farmer. (O)
879. Saint Maur, Kate. A self-supporting home. (N
880. Savage, W. G. Milk and the public health. (N) 83.

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I Maine Agricultural Experiment Station,[1] Orono, Me.
J New Hampshire Agricultural Experiment Station,[1] Durham, N. H.
K New York, Cornell, Agricultural Experiment Station,[1] Ithaca, N. Y.
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[1] Apply to the director.

APPENDIX.

TYPES OF MASSACHUSETTS AGRICULTURAL SCHOOL.[1]

By WILLIAM T. BAWDEN,

Managing Editor of "Vocational Education."

At a meeting of representatives of State departments of education held at Staten Island, N. Y., the Massachusetts plan of agricultural instruction was described by its originator and director, Rufus W. Stimson, agent for agricultural education of the State board, Boston. So much interest was manifested by the men from the other States that Mr. Stimson invited a group of those present to accompany him on one of his trips of inspection in order to visit a number of schools in operation and to study the experiments at first hand. The party consisted, in addition to Mr. Stimson, of three representatives of State departments of education having charge of the work in agriculture—Layton S. Hawkins, Albany, N. Y.; Lindley H. Dennis, Harrisburg, Pa.; Lewis H. Carris, Trenton, N. J.—and the writer of this report.

The party met at Northampton, Mass., on Monday morning, June 9, 1913, visited schools in the immediate vicinity, and proceeded thence to Hadley, Amherst, Petersham, and Northboro. The trip was made in Mr. Stimson's touring car, which not only added greatly to the enjoyment of the party, but also made it possible to cover more territory than could have been attempted otherwise and permitted visits to a number of the boys on their home farms. On Wednesday evening the automobile trip of over 200 miles came to an end at the Back Bay Station in Boston in time to catch the 5 o'clock train for New York.

The first school visited was Hopkins Academy, at Hadley, a village of about 2,000 inhabitants. Under the principalship of Franklin E. Heald, this school three years ago introduced a four-year vocational agricultural course. By thus attempting to adjust itself more closely to the needs of a small community in which farming interests were at least equal in importance to those of higher education, a most interesting transformation has been wrought in a typical traditional New England classical academy. The records show that under the old conditions the proportion of entering students who were graduated reached the low-water mark of 40 per cent, whereas last year it was 88 per cent.

The work in the agricultural course is of secondary grade, and it is regarded as desirable, though not absolutely essential, that pupils shall have completed the work of the elementary school. There are 20 boys in the school, of whom 12 are taking the course in agriculture. The instructor is E. J. Burke, a graduate of the Massachusetts Agricultural College. The students of the first two years meet the instructor in the morning, and those of the last two years in the afternoon. Practically all of the boys spend their free half days in taking the regular academic subjects planned for the course, which is as follows, the numerals indicating number of periods weekly:

First year: Agriculture, 20; English, 5; general science, 3; social science, 3.
Second year: Agriculture, 20; English, 4; biology, 5.
Third year: Agriculture, 20; English, 4; chemistry, 5.
Fourth year: Agriculture, 20; English, 4; physics, 5.

[1] This appendix reproduces portions of a report which was jointly agreed upon by the four visitors named in the first paragraph, which was written by Mr. Bawden, and which was published in the November, 1913, issue of *Vocational Education*.

The school is not large enough to make practicable special classes in science and English for the agricultural students; so the simple plan has been adopted of enrolling them in the regular classes. Whenever the home project work requires the entire time of a pupil, he is excused from all classes temporarily. One small classroom, with no special equipment, has been set aside for the work in agriculture. The school grounds include space for demonstration plats, and a small orchard which has been used as a laboratory for the study of spraying, grafting, etc. The land and orchard are not essential parts of the scheme, however; so that it could be duplicated in any village or rural high school situated within reach of boys living on the farm.

The second type of school visited is the Smith's Agricultural School at Northampton. The feature of this school that interested the visitors most is its unique architecture. The illustrations suggest how admirably the building is adapted to its purpose (see p. 32.)

By placing four building units so as to inclose a rectangle of suitable dimensions (Plate A), and roofing over the inclosed space, an "arena" is provided which serves a number of distinctive purposes (see Plate B). The auditorium, with its raised seats, is so situated as to command a view of the inclosure when sliding partitions are lifted. On Wednesday, May 28, 1913, a horse show was staged which lasted through the afternoon and evening. Prize ribbons were awarded for exhibits in 17 different classes. The boys put up a tent and built temporary stalls in the rear of the building to shelter the animals, and the arena afforded an ideal place for the exhibits (see frontispiece). The display included single and double teams of draft and of driving horses, boys and girls riding in the saddle, Shetland ponies driven by children, and fast horses.

An expert from the Massachusetts Agricultural College was present to assist in judging the exhibits, and, as part of the evening program, an official announcer drew attention to the fine points of the various winning horses. At appropriate times the prize horses were led before the audience, and the practical demonstration of horse judging was made complete. There was no lack of fine horses, as exhibits were entered from near-by stock farms and even from as far away as Springfield.

Concerning the school itself the following statements from the announcement are explanatory:

> The institution has three affiliated schools: School of agriculture, girls' school of industries, and boys' school of industries. The different trades and occupations taught in the school are known as departments. The boys' school of industries already has a department of cabinetmaking and a department of machinists, and is considering the advisability of establishing a department of house carpentry. The girls' school of industries already has a department of homemaking, and is considering the advisability of establishing a department of sewing and dressmaking.
>
> The industrial work of each department is in the hands of trained and competent workmen. In all cases these workmen are taken from active life rather than from the teaching profession. In addition to the expert workmen found in the industrial work, experienced teachers have charge of the students in their nonindustrial work in English, history, citizenship, science, etc.
>
> The work of the students falls under three heads, with the following time allotment: Productive work, 50 per cent; subjects closely related to the productive work, 30 per cent; subjects that prepare for citizenship and leisure, 20 per cent. While not slavishly followed, this is regarded as the best distribution of a student's time that we can make in the present status of vocational education.
>
> The school is available for any boy or girl between the ages of 14 and 25. No educational qualifications are demanded. Boys and girls who have not completed the seventh grade find the work exacting. They are not, however, excluded from the school until they demonstrate their inability to do the work. No student is allowed to remain in the school who does not come for the purpose of learning a trade or mastering an occupation or who does not show sufficient ability to master the requirements of the industrial part of his work.
>
> In a word, the institution is for any boy or girl at least 14 years old who does not, for one reason or another, intend to continue in the regular public school, and who wants to fit himself or herself for earning a living in an occupation or trade. * * * The school does not aim to fit its pupils to meet the examinations of other educational institutions.

The director of the school is Dr. Herbert N. Loomis; Thomas Bradlee is in charge of the agricultural work; Walter S. Graffam is head of the boys' school of industries; and the work for girls is under the direction of Miss Mildred J. Taylor and Miss Catherine A. Murray.

The third type of school visited is the consolidated rural school, with high-school department, at Petersham. This school is out in the open country, 10 miles from the nearest railroad, and occupies a beautiful site of about 10 acres on a hilltop. The equipment of the school includes a greenhouse 20 by 30 feet. The principal is F. D. Reed, and the director of the agricultural work is L. B. Boston.

When the visitors entered the room the class in agriculture was at work upon a very practical problem in balanced grain rations, which grew out of a letter which the instructor had received the day before. The letter was from a neighboring farmer and read as follows:

I am uncertain as to what is the best grain ration to feed my three cows, and any information along this line would be appreciated. They are in a rather poor pasture and I am at present feeding grain as follows:

"Spot," a grade Holstein calved March 4; April milk yield, 1,075 pounds; May, 1,175 pounds; at present giving from 33 to 36 pounds per day; gets 2 pounds cottonseed meal, 4½ pounds corn meal, and 4½ pounds wheat bran per day.

"Daisy," a brown Jersey due to calve July 8; giving about 12 pounds milk per day; gets 2 pounds bran and 2 pounds corn meal per day. This cow will be dried off within a couple of weeks, but I would like to know how to best handle her when fresh next month.

The third cow is of no particular breed that I know of; was fresh last September and due to calve next September; giving 15 to 18 pounds of milk per day now; she gets 2 pounds corn meal, 2 pounds bran, and 1½ pounds cottonseed per day.

I am selling whole milk to one of my neighbors at 40 cents per 8¼ quart can and want as cheap a grain ration as possible to produce a large flow of milk.

Working from the given data the class prepared a statement of the proper methods of feeding, together with an estimate of the probable financial return. It would be difficult to find a more suggestive example of the ways in which the present-day school is recognizing and meeting its opportunities for social service, utilizing them at the same time for the maximum of educational values.

In this school, as in the others described, the agricultural instructor devotes his entire time to two sections of students, a beginning section in the mornings and an advanced section in the afternoons. A boy may take this work only, spending the rest of the time on the farm, or on his free half days he may elect one or more of the regular high-school subjects.

The fourth school is that at Northboro, under the direction of John H. Fay. It is in successful operation without any land for laboratory purposes. Class study is carried on in a vacant store rented for the purpose, and all projects are carried out on the home farms.

INDIVIDUAL PROJECTS DESCRIBED.

The following is the very interesting record of Chester Spinney, Petersham school, for the summer of 1912: Vegetable garden, five-eighths acre, net profit, $44.35; credited self for labor, $12; boy's return, $56.35; this vegetable garden constituted the "project" which he carried on under school supervision. In addition, he set out and cultivated 1,000 strawberry plants; raised 1 acre of corn and one-fourth acre of potatoes; plowed and planted 1 acre of millet and one-fourth acre of buckwheat; cared for 3 cows, 1 horse, and 50 hens. Chester's father was incapacitated by an accident, so that the boy did all the work that was done on the home place that summer. A careful account was kept of work performed and produce sold, which showed that he was entitled to a credit of $164.60 for this nonproject work. Thus the grand total of return for the project period, which included the growing and the harvesting seasons, was $227.03.

During the present season, 1913, Gordon Nightingale, also at the Petersham school, is undertaking as his "project" the care of 4 dairy cows, raising 3 calves, 2 pigs, and 175 chickens. He is keeping careful records of the feed consumed, the amount and quality of milk produced, and eggs and chickens marketed. Besides this school-supervised work he has assumed the responsibility of one-half acre of vegetable garden and 1 acre of corn; he set out in the spring an orchard of 3½ acres, 345 trees of three varieties of apples, and between the rows of young trees is raising crops of corn, turnips, and mangels. Figure 4 shows one of Gordon's daily reports.

In 1912 Albin Anderson, a pupil at the Northboro school, undertook as his project one-sixth acre of potatoes, his father at the same time putting in a crop of 3½ acres. Both sprayed with arsenate of lead to protect the growing plants from the potato beetle. In addition, as a result of what was learned in school, the boy sprayed with Bordeaux mixture in July in the effort to control blight. The father, however, could not be persuaded that the extra labor was worth while, the usual decrease in the potato crop in this section due to blight being regarded as inevitable. At harvest time the boy's methods were more than vindicated by a good yield of excellent quality, while the plants in the father's entire field were killed early by blight and the yield was markedly deficient.

In this connection it may be appropriate to refer to another instance of a school's contribution, through its teacher, to the solution of practical farm problems, the details of which came to the attention of the agent of the State board. It happened one day that a valuable horse was severely gored in the flank by a vicious cow. There was no one about the neighborhood who could care for the wound, and in fact its seriousness was not fully realized at the time. It seemed to be necessary that the horse be kept at work, and this, with the warm weather, soon produced a condition of fever, swelling, and suppuration, and the farmer realized that he was threatened with the loss or disablement of a valuable animal. About this time the agricultural instructor came to visit the boy's project, and noticed at once the critical condition of the horse. He secured some silk thread from the farmer's wife, and suture needles from his kit, prepared an antiseptic solution, and with the assistance of the boy and his father treated the wound. He then instructed the boy in the proper care of the wound, and in a few days it healed perfectly. The farmer informs his neighbors now in no uncertain terms that "that young fellow they've got down there to teach farming *knows his business.*"

In the school at Northboro an experiment in fattening chickens for the market was undertaken as a class project in October, 1912. Each of the 11 members of the class brought in 4 chickens. These were all spring cockerels, culls from flocks that were not considered suitable for carrying through the winter. The fattening of these for the market, therefore, was one of the normal problems of the poultry raiser.

Crates were built in which the chickens were confined during the time of the experiment. They were fed twice daily, at 7 a. m. and 7 p. m., all they would eat of a batter made of corn meal and wheat middlings mixed with skim milk. Thirty minutes daily for the 18 days were required for the work of feeding, 2 hours for weighing, and 6 hours for killing and dressing; total labor, 17 hours. The following is a table of the cost items, labor not being considered:

Grain, 175 pounds, at $0.0175	$3.07
Skim milk, 11 cans, at $0.15	1.65
Leg bands, for identification of birds	.35
Use of crates, 10 per cent of cost	.40
Cost to feed 44 chickens	5.47
Cost to feed 1 chicken	.13

Each pupil kept a careful record throughout the progress of the work and performed the necessary computations to determine the profits realized. Such an experiment,

besides training in methods of procedure, should throw light on the conditions under which it pays to fatten for the market, and when it is better business to sell without the labor and expense of fattening. The opportunities for related work in mathematics and language are sufficiently obvious.

CONCLUSIONS.

This account must now be brought to a close with a brief summary of the important considerations that come to the mind of the critical observer of the Massachusetts plan.

1. **High per capita costs.**—Creative work of the type observed in these schools means the maintenance of a high level of enthusiasm on the part of the workers, as well as constant intimate contact with the very practical and vital economic problems of farming. In common with creative work in any other line of endeavor, it demands men of more than average energy and initiative. Under existing conditions of supply and demand, it has been impossible to find instructors with the necessary qualifications for this work at anything like the prevailing rates of salaries for teachers. In the schools visited on this trip the salaries of the agricultural instructors range from $1,000, for one in his first year on the job, to $1,800. In more than one instance the agricultural instructor is paid more than the principal of the school. As already noted, each such instructor is expected to devote his entire time to approximately 20 students.

It is necessary to face squarely the objection that education under these conditions is expensive. It would certainly be so regarded in certain parts of the country, for example, where the people are accustomed to paying teachers in the rural schools $500 or less. The decision that a proposed course of action is expensive, however, must rest upon other considerations than a mere statement of cost in dollars and cents; such as, what returns from the expenditure can be shown, what will be the results of adopting the alternatives of doing without or managing in some other way, how badly is it needed?

Here is found the justification for State aid. After it has been established that the proposed form of education is important and necessary, it still fails of being put into effect in many places because the extra burden is too great for the community to assume. But the expected advantages are not to be confined to the community; hence the State is justified in encouraging the needed development by financial assistance. According to the terms of recent legislation in several States, the State pays two-thirds of the salary of the teacher, or one-half of the operating expenses (substantially the same amount of assistance), and thus reduces the burden to a point where the community can properly assume it.

It is to be remembered, further, that these teachers are employed on a 12-months' contract, which allows one month's vacation and requires each teacher to spend two months, during the winter, in "professional improvement" preparing for increased efficiency. This study is done under the supervision of the State agent. The instructor is, of course, on duty all the time during the planting, cultivating, and harvesting seasons.

2. **Agricultural education an investment, not an expense.**—Without doubt, there are localities where the duplication of the Massachusetts experiment would be rank extravagance, or possibly waste of public money. The indiscriminate introduction of such work everywhere would be a most unreasonable proposal. The present tendency, however, gradually coming to consciousness, is to regard money devoted to education as essentially of the nature of investment rather than expense. When this view is applied to agricultural education, in common with other forms of vocational education, its significance is more easily grasped than in the case of general education. And it is not necessary in making this statement to contend that the

general proposition is any more true in the former case than in the latter, because it is easier to see it and to demonstrate it.

3. Practical nature of the work.—The feature of the plan that most impresses the visitor is the practical nature of the work undertaken. The instructor is a master of real farm work, and, with his students, deals directly with live farm problems and not with artificial experiments in a school garden or laboratory.

4. A sane point of view.—The members of the visiting party were unanimous in expressing their approval of the fundamental principles upon which the Massachusetts plan is based. The entire experiment rests upon a strictly vocational basis. No boy is admitted to one of these classes who does not actually live at home upon a farm, or who is unable to arrange to do productive farm work, since parent or guardian or employer must guarantee to the school that the boy will have unrestricted control of the piece of land, flock of poultry, or other agreed-upon conditions of the proposed project. The amount of time to be allowed for the work is also expressly understood.

The instructor, up to the limit of his ability, takes a fatherly or brotherly interest in many vegetable and flower gardens in the neighborhood; he acts in an advisory capacity to as many of the agricultural undertakings of grammar-school boys and girls as he can reach; but this is all on the side. If the State department of education would recognize such work, and give the necessary authorization for such supervision, it could greatly reduce the per capita cost. But it has deliberately decided to limit itself, so far as formal recognition is concerned, to work of an intensive kind with boys and girls who have definitely chosen to undertake real responsibilities and who are mature enough to profit by the experience.

In thus limiting formal recognition to supervision of boys and girls who have definite plans for farm work, the board does not intend to minimize the importance of school garden work and other similar enterprises among the elementary school children. While such work can not be regarded as strictly vocational, it does have great prevocational or avocational values. In order to conserve all these values, efforts are constantly made to stimulate and direct the activities of the regular teachers and the cooperation of interested groups of citizens. Help is offered in planning and conducting "growing contests" and public exhibitions under school auspices.

So far as the instructors are concerned there is constantly kept in mind the aim of systematically becoming acquainted with the best types of farming in the community and then of exercising a helpful influence in those districts where it is most needed. Every effort is made to promote more permanent tenure of position on the part of the teacher and genuine interest and pride in the locality which he is trying to build up. In this work, as in all school work, the disastrous effects of a constantly changing teaching population constitute almost the worst obstacle that must be contended against.

5. Supervision of unusual efficiency.—The master mind and the source of inspiration in this whole movement is the State agent. More than once the visitors were witnesses of his skill in meeting and utilizing situations as they arose. The instructor may be with the agent for several hours as they go about together in the automobile visiting each boy at his project. This time is spent in earnest consultation about the details of the work, in the giving of advice and suggestion, and in conveying some messages of encouragement from a successful project under way elsewhere, and, finally, in the necessary criticism and correction of mistakes. The State agent is constantly in touch with the boys and their parents, upholding the hands of his instructors and, with the school trustees and members of advisory committees, inspiring them with appropriate commendation and with accounts of the achievements of other districts.

The value to the teachers of the continual object lesson in sympathetic expert supervision can hardly be overestimated. So far as the members of the visiting

party are concerned, it was agreed that this was one of the most helpful suggestions carried away from the entire trip.

6. All problems not yet solved.—The reader should not gain the erroneous impression that a perfect system has been evolved and that but little remains to be done but to transplant it. There are plenty of unsolved problems; that is why the work is so interesting. High per capita cost, the conservatism of rural populations, the difficulty of securing and retaining efficient teachers, the perfecting of machinery and methods—these and other problems will continue to demand thoughtful study. Even the boys and girls present problems of their own in the rural school, as in the city school. Every instructor in vocational subjects will be able to sympathize with the agricultural instructor who finds the progress of his work impeded by the necessity of dealing with the boy who just wants to try it to see what it is like and the boy who discovers other interests as soon as it appears that the new kind of school means real hard work.

7. The experiment successful.—If it would be misleading to leave the impression of achieved perfection, it would, on the other hand, be unjust to withhold commendation of the plan as a whole. It is not necessary for the visitor to take the instructor's or the agent's word for it; he can observe for himself that the new kind of school is training in vocational efficiency, is developing boys and girls of energy and initiative, is fostering a spirit of independence and perseverance, and is accustoming young people to the experience of successfully coping with real difficulties.

The work of these agricultural schools and departments is principally with boys and girls who have discontinued their work in the regular schools or who have indicated a desire for some form of training other than that preparing for higher schooling. In making successful men and women out of boys and girls whose needs have been met only in part by the existing schools, and in providing a training in vocational efficiency, with due regard to social responsibilities, for those who can not utilize the traditional high-school and college education, the agricultural school is meeting genuine social needs.

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